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# Roadmap for NZEBR and RES in Finland

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**Lead contractor: VTT**

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# 1 SUMMARY

The NeZeR project promotes the implementation and smart integration of Nearly Zero Energy Building Renovation (NZEBR) measures and the deployment of Renewable Energy Sources (RES) in the European renovation market. Roadmaps for the implementation of NZEBR and uptake of RES were created in Finland, Romania, Spain, Sweden, and The Netherlands.

The roadmaps include general descriptions of how to achieve mainstream NZEBR and utilization of RES from the perspectives of different stakeholder groups. Important identified stakeholders are city authorities, property owners and housing owner associations, construction sector (architects, developers, manufacturers) and the end-users. However, the most important stakeholders were selected in each country from the viewpoint of respective conditions. This report presents the roadmap for Finland.

The purpose of the roadmap was to complement the action plans developed earlier in the NeZeR by concretizing actions that various stakeholders need to take to make NZEBR as the prevailing means for refurbishment.

NeZeR defined that a roadmap is a strategic plan that describes the steps needed to achieve targeted goals. The roadmap describes tasks and priorities for actions and suggests metrics that allow monitoring of progress towards the final goals.

The roadmap process included the following phases: Planning and preparation, Development of a roadmap document, Review and consultation with key stakeholders; Refining and launch of the roadmap. The third phase of the Finnish roadmap took place in the collaboration with the NeZeR national cluster, which included representatives of different stakeholders, and with the help of interviews. With regard to each identified important stakeholder group, the roadmap described gaps and barriers, action items, impacts, and indicators.

The importance of different stakeholder groups was assessed from the viewpoint of their power and interest to implement NZEBR. It was concluded that the cities and different kinds of building owners and investors are the most important groups as they have power and some owners also have relatively high interest. In addition, manufacturers - as innovators of attractive, effective and profitable solutions for energy-efficient renovation - represent a very important stakeholder group. Correspondingly designers and architects – as experts for the design and development of solutions for NZEBR – are an important stakeholder group.

The actions that were seen the most important are summarised in the following:

## ***Environmental label and declaration schemes as drivers for development***

Currently the energy subsidies are granted as a percentage of realized costs of the renovation project. If the size of the subsidy would depend on the energy performance improvement level, the motivation to take up efficient energy saving measures would be higher. The effect of different renovation solutions on energy performance must be clear and the environmental labels and declaration schemes should guide customers to choose the best available solutions. The building product industry and organizations have an important role in promoting the use and development of labels and declarations.

## ***Selling indoor environment quality instead of technical solutions***

The effect of increasing energy-efficiency on improvement of indoor environment quality needs to be clearly presented. Manufacturers, research institutes and universities have a central role in providing evidence and the ministries and decision makers have an important role in funding the research and dissemination of knowledge.

***Processing best practice examples into functioning, replicable concepts.***

The best practices, lessons learned from successful renovation cases and good examples should be disseminated to housing investors and housing companies.

***Comprehensive approach and consideration of life-cycle aspect as a compulsory prerequisite***

The current building code for renovation requires that energy-efficiency is taken into account in all extensive renovations. The municipal building supervision is responsible for permissions. The renovation solution should be comprehensive and take into account all potentials for energy-efficient renovation. E.g. when the water pipe system is being renewed also the possibility of renewing the ventilation system at the same time should be considered.

***Supporting the boards in long-term planning and consideration of energy-efficiency***

Legislation should be developed to make decision making for housing companies easier. The responsible actors for this are political decision makers.

Five year plans (sc. PTS) are compulsory for housing companies but the time line should be longer. Boards and their chairs should be encouraged and supported to make long term plans and to consider energy-efficiency in each step. Housing managers have here an important role. However, they should be supported to improve their skills and understanding about technological potentials, profitability and social aspects related to NZEBRs.

***Directing incentives on the implementation of long-term plans especially for low-value buildings***

The ministries together with political decision makers should study the potentials of different incentives and use those effectively. For example:

- Energy subsidy for changing the heating system or implementing renewable energy is at the moment provided only for low income households, who probably do not have the resources to change their heating system or take up energy saving measures. Therefore, the energy subsidy is not very efficient in the current form and the target group should be enlarged to comprise also those households who are the most probable ones to take up energy saving refurbishment measures.
- Domestic reduction for housing companies: Currently only individual apartment owners can receive domestic reduction for renovation measures. Domestic reduction also for housing companies would motivate taking up renovation activities in multi-family buildings.
- State guaranteed loans or energy subsidies directed especially for apartment building refurbishment in periphery areas where the apartments have very low value because of the decreasing population and therefore decreased demand of housing. This would help these housing companies to get renovation loans from the financing institutes.

***Development and use of energy saving agreements among owners***

When the owner of an apartment changes a certain percentage of the value of the transaction needs to be paid as transfer tax. This amount could depend on the energy performance level of the building which would motivate the owners to invest in improving energy efficiency.

***Energy-efficiency and RES as image improving issues***

Municipalities and other public actors and owners of buildings should show example and disseminate transparent information about the achieved energy-efficiency levels and other benefits related to NZEBRs. High-level energy-efficiency of renovated buildings and use of RES should be declared for the users of the building.

## 2 INTRODUCTION

The NeZeR project promotes the implementation and smart integration of Nearly Zero Energy Building Renovation (NZEBR) measures and the deployment of Renewable Energy Sources (RES) in the European renovation market. The scope of NeZeR is in urban residential houses and dwellings. The specific types of residential houses are selected in each of the five partnering countries in order to choose the most important national house types.

The aim of the project is to make NZEBR the prevailing means for refurbishment and to improve the performance of the existing residential building stock, decrease the energy use of the building stock, achieve significant emission reductions of the building sector, and decrease the non-renewable energy dependency of Europe.

In order to facilitate the implementation of NZEBR and uptake of RES, roadmaps for NZEBR and RES have been created. The focus countries are Finland, Romania, Spain, Sweden, and The Netherlands. This report presents the roadmap for Finland.

The roadmaps include general descriptions of how to achieve mainstream NZEBR and utilization of RES from the perspectives of different stakeholder groups, e.g. city authorities, property owners and housing associations, construction sector (architects, developers, component producers) and the user perspective. However, it has been up to each country to select the most important stakeholders from their respective conditions.

### 2.1 Purpose of the roadmap

The purpose of the roadmap is to complement the action plans developed in the earlier in NeZeR by concretizing actions that various stakeholders need to take to make NZEBR the prevailing means for refurbishment. The roadmap may contribute to achieving the EU targets for existing buildings, mainstreaming NZEBR in the NeZeR countries and enable implementation of the action plan by guiding the stakeholders.

### 2.2 Methodology

Generally, a roadmap can be described as a strategic plan that describes the steps needed to achieve stated outcomes and goals. In this project it includes tasks and priorities for action and suggestion of metrics that allow the tracking of the progress towards the final goals. The tracking process will occur after finalizing the NeZeR-project.

The roadmap development process has been divided into three phases:

- Planning and preparation
- Development of a roadmap document
- Review and consultation with key stakeholders
- Refining and launch of the roadmap

The methodology for identifying actions for various stakeholders, their impact and indicators for future monitoring, followed a 4-step-procedure illustrated in Figure 1.

The roadmap has been created in close cooperation with the national NeZeR clusters. One national cluster workshop was organized specifically to provide input to the development of the roadmaps for the different stakeholder groups. After the workshop all data was gathered and some additional interviews were carried out to reach other stakeholders and to confirm the outcome.

During the workshop it was important to give the stakeholders the right conditions, rather than steering them. The stakeholders are the actors on the NZEBR market. Nevertheless, to get a roadmap that is as concrete as possible the stakeholders were asked to also include policy instruments for example legislation, incentives and information.

	GAPS AND BARRIERS	ACTION ITEMS	IMPACT	INDICATOR
Government				
Authorities				
Municipal Decision Makers				
Architects, Designers and Consultants				
Larger property Owners (Municipal)				
Construction Companies				
Tenants				

Figure 1. Example of roadmap matrix.

### 2.3 Scope and boundaries and connection to other NeZeR work

The roadmap has been drawn on a national level, from the perspective of different stakeholders, previously identified in work packet “Impact through national clusters”. The roadmaps also take into account the technical, functional, and economic aspects, addressed within work packets “Criteria for NZEBR technologies and solutions” and “Feasibility of NZEBR over traditional renovation”.

Results from above work packets on technical and non-technical aspects have been kept in mind during the development of the roadmap. The roadmap provides recommendations on future actions for different stakeholders with special attention to the challenges and non-technological barriers for NZEBR and RES identified for different stakeholder groups.

The roadmap differs from the city action plans, also developed in NeZeR, in the sense that they focus on the stakeholder perspective including the individual perspectives of different stakeholders. The action plans were developed for the cities and the roadmaps, on the other hand, have been created on the national level and for different stakeholders. However, the action plans have been used as input for creating the roadmaps.

## 2.4 Identified stakeholders

The most important stakeholders to include in the roadmap development were identified based on the stakeholder analysis performed in NeZeR project.

The stakeholder groups were prioritised in order of importance, by considering both the power and the interest of each stakeholder group. This was done by grouping the stakeholders into either of the following (see also Figure 2).

- **Key Players (KP):**  
High power (level of power >3-5) AND high interest (level of interest >3-5)
- **Meet their needs (MTN):**  
High power (level of power >3-5) but low interest (level of interest 1-3)
- **Show consideration (SC):**  
Low power (level of power 1-3) but high interest (level of interest >3-5)
- **Least important (LI):**  
Low power (level of power 1-3) AND low interest (level of interest 1-3)

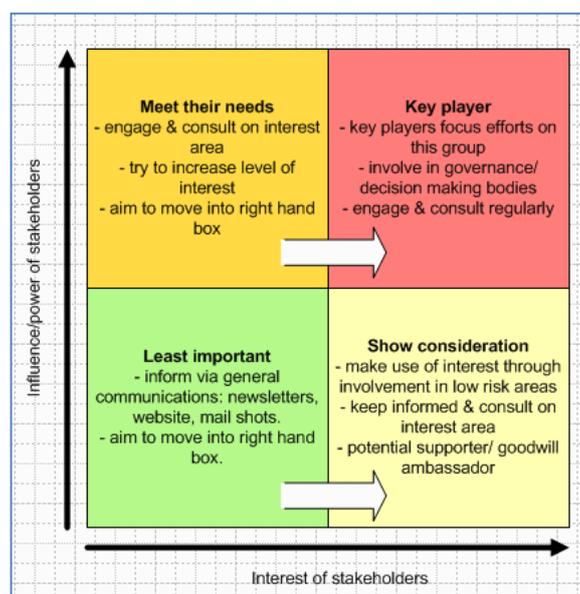


Figure 2. Map of power/influence versus interest of stakeholders (Bryson, 1995 and Eden & Ackermann, 1998).

The assessment result is presented in the next table.

Table 1 Assessment of the level of power and interest for NZEBR and RES of the stakeholder groups in Finland (1=very low, 2=low, 3=neither high nor low, 4=high, 5=very high)

Stakeholder or target group	Level of power	Level of interest
Architects	3	3
Architects (project planning, consulting)	4	3
Architects (single building)	2	3
Boards of housing companies	4	3
House owners	5	3
Private building owners	4	3
Building investors (public and commercial)	4	3
Cities (own buildings)	5	4
Construction companies (contract work)	1	1
Consultants	3	3

Developers	3	2
Energy Supply Companies (others)	4	2
Energy Supply Companies (owned by cities)	4	4
ESCOs	3	4
Facility Management	2	1
Governmental decision-makers (politicians)	4	4
House managers	4	3
Investors and banks	5	2
Manufacturers NZEBR components	4	5
Manufacturers RES components	4	5
Media, general papers	4	3
Media, trade papers	4	5
Ministries	4	5
Municipal decision-makers (politicians)	4	3
Municipal authority and licensing authority	4	4
Other organisations	3	5
Planners (building services)	3	3
Planners (construction)	1	2
Rental / housing associations	5	4
Research Organisations	3	5
Universities/Education	3	5

However, the whole NeZeR cluster was invited to the roadmap workshop. The stakeholders and experts of the national clusters were thus involved in the process.

## 3 BASELINE

### 3.1 Current situation, building stock, energy use

Below is a description of the baseline situation in EU and Finland.

#### *Common important user needs and market barriers*

Directive 2010/31/EU (EPBD) on the energy performance of buildings states that existing buildings undergoing major renovation shall fulfil minimum energy requirements. Renewable energy production shall be included if this is technically, functionally and economically feasible. The EPBD has resulted in the development of national building codes, norms for calculation of the energy performance of buildings and energy certification of buildings. However, major renovations aiming for nearly zero energy performance have not yet had a market break through.

The initiators and planners of the energy upgrade face several barriers of different categories. The economic barriers include low energy prices (to change behaviour) and the lack of cost effective products. Tenants' and building owners' lack of knowledge regarding energy use and energy efficiency improvement form a knowledge barrier. Priority to comfort and high indoor temperatures and priority to personal gains over responsibility for the environment are examples of individual and cultural barriers. Structural barriers relate to the lack of feedback on energy use, the lack of services for energy efficiency as well as organizational barriers related to the decision making processes in housing cooperatives. Political barriers include insufficient coordination of initiatives, incentives and regulations.

Energy efficient renovation measures have been investigated in several research projects in the participating countries. In spite of the ambitious and relevant research results the gathered information is still shattered in various reports and weakly disseminated among practitioners, building professionals and decision-making stakeholders. The decision makers need knowledge on the gains of energy efficiency. This is valid both for private and professional decision makers. Knowledge today is often only accessible for specialists and is not communicated towards the public.

#### *Current situation in Finland*

In Finland the housing stock has 2.8 million actual dwellings with a high proportion of flats in blocks (44%). From the total housing units 84% are situated in urban environment, most of them are flats, so the proportion of buildings is smaller, 73 %. The share of multi-family buildings (existing buildings) is 46%. The share of residential buildings measured by quantity of houses is 90% and by floor area only 74%. Nearly all housing units (98%) are situated in residential buildings. A relatively large housing stock was built in the 1950s, '60s and '70s. The share of these houses in terms of total housing stock is 43%. This is the most interesting housing stock from renovation business point of view not only because of volume but also due to their renovation need. Also many of the unoccupied dwellings were built during time the period 1950-1979. The reason for big production volumes of blocks of flats in the '60s and '70s was internal immigration from rural areas to urban areas. Because of this, the most common dwelling type in this age group is either owner or tenant occupied flat. The terrace house building boom was in '80s. The block of flats of '60s and '70s are concrete prefabricated and their energy efficiency is even worse than older brick built buildings. The first energy requirements for buildings were set in 1976 and buildings built after that are more energy efficient than older buildings. Nearly all multi-family residential buildings in urban

environment are connected to district heating. A weak signal has been noticed that also owners of large houses are interested in ground heating.

The following tables present the floor areas and share of the Finnish residential buildings built in 1950 – 1989.

Table 2 - Share of the building type at specified years of residential building stock in category

Country	Years	Share of floor area from different residential building types			
		Detached houses	Attached houses	Multi-storey buildings	All residential building types
Finland:	1950-1989	27 %	7 %	19 %	53 %

Table 3 - Floor area of the building type at specified years of residential building stock in category

Country	Years	Floor area (m <sup>2</sup> ) of all residential buildings				Residential buildings total
		Detached houses	Attached houses	Multi-storey buildings	All residential building types	
Finland:	1950-1989	78 728 547	21 207 492	56 078 074	156 014 112	292 588 300

Residential buildings in building are owned by public and private housing investors and by private people – who are often also owner-occupants – either directly or through limited liability housing companies. The latter is an arrangement in which an association or corporation owns a real estate including a group of housing units and the common areas for the use of all the residents. The individual participants own a share in the cooperative which entitles them to occupy an apartment (or town house) as if they were owners, to have equal access to the common areas, and to vote for members of the Board of Directors which manages the cooperative. The following table presents information about the share of ownership base on the Finnish statistics.

Table 4 - The share of ownership

All owner-occupied dwellings (Cooperative housing, Limited liability housing companies and Homeowner associations)	1 698 803
All rented dwellings	823 694
of which subsidised/city/ government owned rented dwellings	334 666
Other or unknown tenure status	95 283
Total	2 617 780

## 3.2 Policies and incentives

Relevant fiscal incentives have also been identified in the NeZeR project report “Proposal of relevant fiscal incentives and other control instruments for supporting NZEBR”, which can be downloaded from the NeZeR website ([www.nezer-project.eu](http://www.nezer-project.eu)). Below is a short summary of the fiscal incentives in Finland.

### *Environmental loans for private owners*

The Nordic Investment Bank (NIB), which is the common international financial institution of the eight Nordic and Baltic countries, provides long-term financing to the energy, environmental, transport, logistics, communications and innovation sectors for projects that strengthen competitiveness and enhance the environment. (Mahapatra et. al., 2011). In Finland, these loans have been channelled to private house owners through the Mortgage Society of Finland, HYPO, since 2010. The environmental loans for individual households are mainly granted for improving the windows or insulation of the building or for installing ground-source heat pumps. Individual house owners form a larger group of the customers but moneywise the share of loans received by housing companies is higher.

### *Domestic reductions for renovation measures*

In Finland work performed at home or at a vacation residence can receive domestic reduction (reduced from taxes) up to 2400€ per person (in year 2015). These measures are improvement works of the house or the vacation residence, such as installation of heat pumps and it is meant only for refurbishment, not new construction. The domestic reduction can be 45% of the performed work if it is done by a company, and 15% if it is carried out by an individual contractor. (vero.fi). Rönty & Paiho (2012) suggest that increasing the domestic reduction could be one way to motivate initiation of energy-efficiency improvement measures.

### *Subsidies provided by the Housing Finance and Development Centre of Finland (ARA)*

The Housing Finance and Development Centre of Finland (ARA) belongs under the Ministry of Environment and is responsible for implementation of the housing policy of the state. Among other things, ARA promotes ecologically sustainable, high-quality and affordable living and provides subsidies, support and guarantees for living and construction. (ARA, 2015)

#### › ***For detached, semi-detached and row houses:***

The discretionary energy subsidy provided by ARA is meant for improving energy economy and decreasing carbon footprint of residential buildings (detached houses or max. two apartments) or for adopting renewable energy systems. There is an income limit for the subsidy. The subsidy can reach 25% of the investment costs. The subsidies are directed to house owners through municipalities.

The energy subsidy can be used to cover costs of the following measures:

- Implementation of a ground source heat pump or an air-water heat pump
- Implementation of a wood based heating system
- Implementation of a compound heating system using renewable energy.
- Improving the external insulation or the windows of the building. (ARA, 2015)

#### › ***For multi-family buildings:***

Since 1.1.2015 the state guarantees loans for modernization projects of apartment buildings owned by housing associations. Until year 2015 this subsidy was provided in the form of interest subsidy loans for modernization projects. The subsidy is mainly meant for pipe

renovations and improvements of the exterior and energy performance of the building. The guaranteed loan can cover up to 70% of the renovation costs of the building and it can be maximum 50% of the value of the building. (ara.fi (a))

ARA also provides subsidies for condition surveys of residential buildings which have suffered from water damage or which are causing health problems. The subsidy can be up to 50% of the costs of the condition survey. (ara.fi (b))

› ***For refurbishment of historically valuable buildings:***

The state budget allocates money for subsidising refurbishment, protection and conserving of buildings with exceptional historical value. The subsidy can be up to 50% of the costs of the renovation measures. On average, the received subsidy covers 5% of the realized costs. The subsidy can be applied by individual owners but also by communities or municipalities who are responsible for the maintenance of a building. (ELY, 2014)

## 4 ROADMAP

### 4.1 General gaps and barriers for NZEBR

Overall gaps and barriers for NZEBR have been identified previously in NeZeR WP2 as:

Economic aspects as well as the decision making process play a relevant role when undertaking NZEB renovations.

In Finland the main barriers for the uptake of building refurbishment measures are often related to either economic constraints or lack of information. Heljo and Vihola (2012)<sup>1</sup> list down the following reasons explaining why renovation measures are NOT taken up:

1. Features of the building:
  - Building is new, in good condition, and there is no need for refurbishment yet.
  - Building is in the end of its life-cycle or it is being used in a secondary way
  - Building has been planned for short-term use.
  - Protected buildings and retaining the historical value of a building make energy improvements challenging.
2. Construction site:
  - The building is located in an area where the need for building has decreased and where there is no economic need or justification for refurbishment.
3. Know-how, attitudes and decision-making
  - 75% of the apartments are owner-occupied and there are several decision makers.
  - The know-how is not sufficient because of too few reference cases.
  - Lack of skills to estimate the energy saving potential of one's own house.
  - Doubts about the suitability of measures in one's own house.
  - Low awareness about technical systems.
  - Old structures are highly valued (for example old windows).
  - There is no time to consider energy saving issues or reasons are not presented clearly enough.
4. Technical aspects and architecture
  - It is technically difficult to implement the energy saving measure (e.g. tile façade, low upper ceiling and placement of channels for heat recovery of ventilation).
  - It is difficult to carry out the refurbishment by successfully retaining the architectural features of the building
5. Cost-effectiveness and resources
  - If no refurbishment need exists, replacement of an element only because of energy saving reasons is most probably unfeasible.
  - Only short-term profitability might be assessed.
  - There is contradictive information about profitability.
  - Financing the project might be problematic.

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<sup>1</sup> Heljo Juhani; Vihola Jaakko. 2012. Energiansäästömahdollisuudet rakennuskannan korjaustoiminnassa. Tampereen teknillinen yliopisto. Rakennustekniikan laitos. Rakennus-tuotanto- ja talous. Raportti 8. [http://www.tut.fi/ee/Materiaali/Epat/EPAT\\_loppuraportti.pdf](http://www.tut.fi/ee/Materiaali/Epat/EPAT_loppuraportti.pdf)

## 4.2 Roadmap for different stakeholders

Through NeZeR-workshops with the Finnish cluster, workshops of the BuildUpon-project and additional interviews a roadmap has been drawn for Finland, which is summarised in **Error! Reference source not found..**

The NZEBR stakeholders in Finland were identified in NeZeR-report “Stakeholder analysis and national Nearly Zero Energy Building Renovation clusters” and divided into four groups based on their level of power and interest for NZEBR:

1. Key Players (KP): High power (level of power >3-5) AND high interest (level of interest >3-5)
2. Meet their needs (MTN): High power (level of power >3-5) but low interest (level of interest 1-3)
3. Show consideration (SC): Low power (level of power 1-3) but high interest (level of interest >3-5)
4. Least important (LI): Low power (level of power 1-3) AND low interest (level of interest 1-3)

Assessed key players with assessed highest level of power (5) are owners of residential buildings energy companies. Owners of residential buildings are private house owners (including owner occupants), municipal organizations that own residential buildings and housing investment companies. Assessed key players with assessed second highest level of power (4) are policy makers, authorities, architects, manufacturers of NZEBR and RES components, and representatives of media and trade magazines.

This report focuses on private owners and investors, designers and manufacturers while the roadmaps of policy makers, authorities and journalists are not dealt with.

The largest private housing owners in Finland are housing investment companies such as VVO and SATO and pension companies such as Varma, Ilmarinen, Tapiola and Keva<sup>2</sup>. The representatives of four of these (2 housing investment companies and two pension companies) were interviewed to find out barriers and action items for energy-efficient renovation.

BUILD UPON is the world’s largest collaborative project on building renovation – bringing together over 1,000 organisations, across 13 countries, at over 80 events in 2016-17. The project is led by 13 Green Building Councils (GBCs) from across Europe. As part of the BUILD UPON project, the Finnish Green Building Council has organized workshops for actors of the renovation field. The first workshop, organized on 31.3.2016, identified the building owners (both private and public), residents (households, private and public rental associations, housing companies), funding institutions, and media as the most influential actors. On the other hand, main stakeholder groups hindering the promotion of energy-efficiency were identified to be households, funding institutes, other public actors (such as the national board of antiquities), media and private residents/owners.

As a synthesis of the results of both NeZeR and BUILD UPON the Finnish stakeholder roadmap was described for following stakeholder groups:

- **Manufacturers of NZEBR and RES components**
- **Designers and architects**
- **Housing companies:** Limited liability housing companies - an arrangement in which an association owns a group of housing units and the common areas for the use of all the residents. The individual participants own a share in the which

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<sup>2</sup> KTI Kiinteistötieto 2011. Jari Ylönen / Tomi Laine / Hanna Kaleva. Vuokra-asuntomarkkinainformaation Kehittäminen. <http://kti.fi/wp-content/uploads/Vuokra-asuntomarkkinainformaation-kehitt%C3%A4minen.pdf>

entitles them to occupy an apartment as if they were owners, to have equal access to the common areas, and to participate in decision making shareholders' meeting.

- **Housing investors:** Companies such as housing investment companies and pension companies, which invest on housing, develop, maintain, give for sail and rent out (barriers and action items are based on the interview results)

#### 4.2.1 Manufacturers of NZEBR and RES components

##### Gaps and Barriers:

The manufacturers lack concepts and implementation models and they also lack time to design new products and systems which fulfil new, tighter building regulations. There is also lack of selling know-how: e.g. how to address the improved indoor environment quality as a selling argument instead of only providing information about technical solutions. On the other hand, designers, contractors and owners may have lack of information about new innovative technologies and relative products for energy-efficient refurbishment.

##### Action Items:

Environmental label and declaration schemes could act as drivers for the manufacturers e.g. guiding towards the development of innovative technologies for energy-efficient refurbishment and more energy-efficient products and utilization of greener electricity and supporting sustainable procurement of raw materials and services in supply chain. Information about the innovative technologies and products suitable for energy-efficient refurbishment should be made available through specific data bases and product declaration systems.

Digitalization could make it easier to listen to the needs of the residents and housing company shareholders. More community feeling and pressure of the masses could increase motivation to design more sustainable solutions.

Allocated, comprehensive services for a larger number of housing companies could support procurement / group procurement. New models for turnkey-solutions and distribution of liability would also be needed.

Also other benefits than energy-efficiency should be highlighted, such as higher indoor environment quality and better living conditions, lower living costs, extending the life-time of the building.

##### Impact:

- Potential decrease of operational energy and carbon in residential housing stock
- Emergence of markets for NZEBR products

##### Indicator:

- Number of new environmental declarations per year
- Number of items of news in leading trade magazines that address new developments of NZEBR components and RES components

#### 4.2.2 Designers and architects

##### Gaps and Barriers:

Boundary conditions for calculations are important but difficult to define; it is more difficult to verify "soft values" with calculations, such as effect on the productivity and increase of the aesthetic appearance of the building.

Attitudes and suspicions: Overall stiffness and reluctance for changes. Lot of information and results of pilot projects are available, but old criteria and ways of thinking are being used.

There should be more research results taken into practice on problem-free concepts. There are also suspicions about the moisture physical functionality and complicated systems. The designers should have more information on the future demands and be proactive.

Lack of good and qualified designers: Education of new engineers is a challenge for teachers and professors.

Partial optimization loses energy-efficiency. Life-cycle aspect should be addressed instead of investment costs. Profitability of the more energy-efficient solutions is unclear.

Customers and users: Nearly zero energy level is not required by the customers. There is lack of guidance of the user so that the renovated building would be used according to the design.

Data management: Original drawings are often faulty and technical drawings, designs and usage manuals according to design are not kept and utilized after the commissioning of the building.

Other barriers: Lack of ready concepts; Lack of whole system control; Energy control and its role; Division of liability; Dissemination and communication; Ineffectiveness of the construction process.

#### Action Items:

New renovation solutions could accelerate the renovation markets. Development of proven solutions is needed.

Change starts from tighter regulations.

Quality: More time should be used for the design process so that the design group can meet as many times as needed. Processing best practice examples into functioning, replicable concepts. Sharing experiences and lessons learnt of succeeded and failed projects.

Highlighting also other benefits than energy-efficiency, such as higher indoor environment quality and better living conditions, lower living costs, extending the life-time of the building.

Utilization of dynamic simulation and building information models also in renovation projects.

Actions according to the requirements of the tender invitation material; Life-cycle aspect should be a compulsory prerequisite.

Development of competence requirements to be applied in the context of demanding design cases of NZEBRs of public buildings.

#### Impact:

- Potential decrease of operational energy and carbon in residential housing stock
- Increased demand for NZEBR design skills
- Increased number of successful NZEBR cases

#### Indicator:

- Number of design competitions which emphasize (nearly) zero energy performance
- Number of articles in trade magazines that introduce NZEBR cases

### **4.2.3 Housing companies**

#### Gaps and Barriers:

Short perspective: Life-cycle viewpoint is lacking; Reluctance for implementation of larger entities and long-term plans.

Lack of abilities and possibilities of housing companies to take into account energy-efficiency in renovation projects: Housing companies' boards lack competence, decision-making skills and courage. Lack of motivation. Lack of good examples. All benefits of renovation are not understood. Lack of knowledge of procurement. Reluctance for new and innovative thinking. Board members do not change often enough.

Lack of funding: Lack of attractive incentives and taxation instruments.

Other barriers: Lack of communication methods with other shareholders. Not enough competence on the required renovation measures.

#### Action Items:

Funding: Support and incentives directed to activate housing companies in preparing long terms renovation strategies and action plans. Tax reliefs and other financial incentives with long-term facility management plan as basic requirement. Supporting group procurement renovation. Requirement for housing companies to establish a renovation fund and channelling a part of the condominium payment into energy-efficiency.

Supporting the boards with information and good examples. Connecting energy-efficiency with systematic facility management and improved living conditions (satisfaction and wellbeing of the residents). Interactivity with the residents.

#### Impact:

- Potential decrease of operational energy and carbon in residential housing stock
- Increased demand for profitable energy-efficient refurbishment services

#### Indicator:

- Number of building permission applications that target on NZEBR level.

## **4.2.4 Housing investors**

### Gaps and Barriers:

Lack of demanding regulations (energy-efficiency is considered in all renovations that need a building permission; energy- efficiency is considered in accordance with current regulations)

Difficulty to understand and utilize the value increase of the building: effect of the building condition on value, rental, usage and maintenance. Valuation of energy-efficiency issues by tenants. Difficulty to commit clients (users, tenants) to energy-efficiency.

Lack of good examples.

Difficulty to decrease the gap between designed energy-efficiency and realised energy-efficiency. Current regulations and guidelines do not support minimization of this gap. The designed energy-efficiency is not transferred to construction as a performance requirement.

Lack of information and knowledge about renewable energy solutions; what requirements can be set; how the fulfilling of requirements can be measured and monitored.

Requirements for profitability. Unwillingness to increase investment cost. The cost of renovation is carefully and strictly monitored.

Lack of information about how to ensure good indoor air quality in very energy-efficient building renovation.

Difficulty to match the requirements of building protection with the requirements of improved energy-efficiency.

A big share of the overall renovation budget needs to be allocated to water pipe system renovation.

Building parts are (preferably) renovated or renewed only when the technical service life is achieved, e.g. the heat insulation of the building envelope is only improved if there are construction technical reasons to renovate the envelope. This principle often hinders simultaneous NZEBR of the overall building.

#### Action Items:

Development of methods and procedures that support energy-efficient user behaviour.

- Development and adoption of smart metering technics to decrease consumption and improve user engagement.
- More active and efficient implementation of building automation solutions, adjustment of building services technologies and use of water and energy saving fittings.

Design: Development and implementation of design guidelines for energy-efficiency. Development of methods that ensure that realised (energy) performance equals with designed (energy) performance.

Development of requirement setting and requirement management – less freedom for construction to deviate from “as-designed”.

Better commitment of clients for energy-efficiency.

Further development and active use of energy saving agreements among owners.

Better use of energy-efficiency and renewable energy solutions as brand or image improving issues.

Better consideration of energy-efficiency aspects in all renovation cases (such as pipe line renovations). Especially heat recovery (both form exhaust air and warm water) is important.

Start of piloting cases which help learning and progress.

Better collaboration with other housing investors to change information and experiences.

Better usage of possibilities of infill building to finance refurbishment (including energy-efficient refurbishment).

District energy solutions.

#### Impact:

- Increased wellbeing and health of the residents.
- Potential decrease of operational energy and carbon in residential housing stock
- Increased demand for profitable energy-efficient refurbishment solutions and services

#### Indicator:

- Number of buildings renovated to NZEBR level

### 4.3 Priorities and timelines

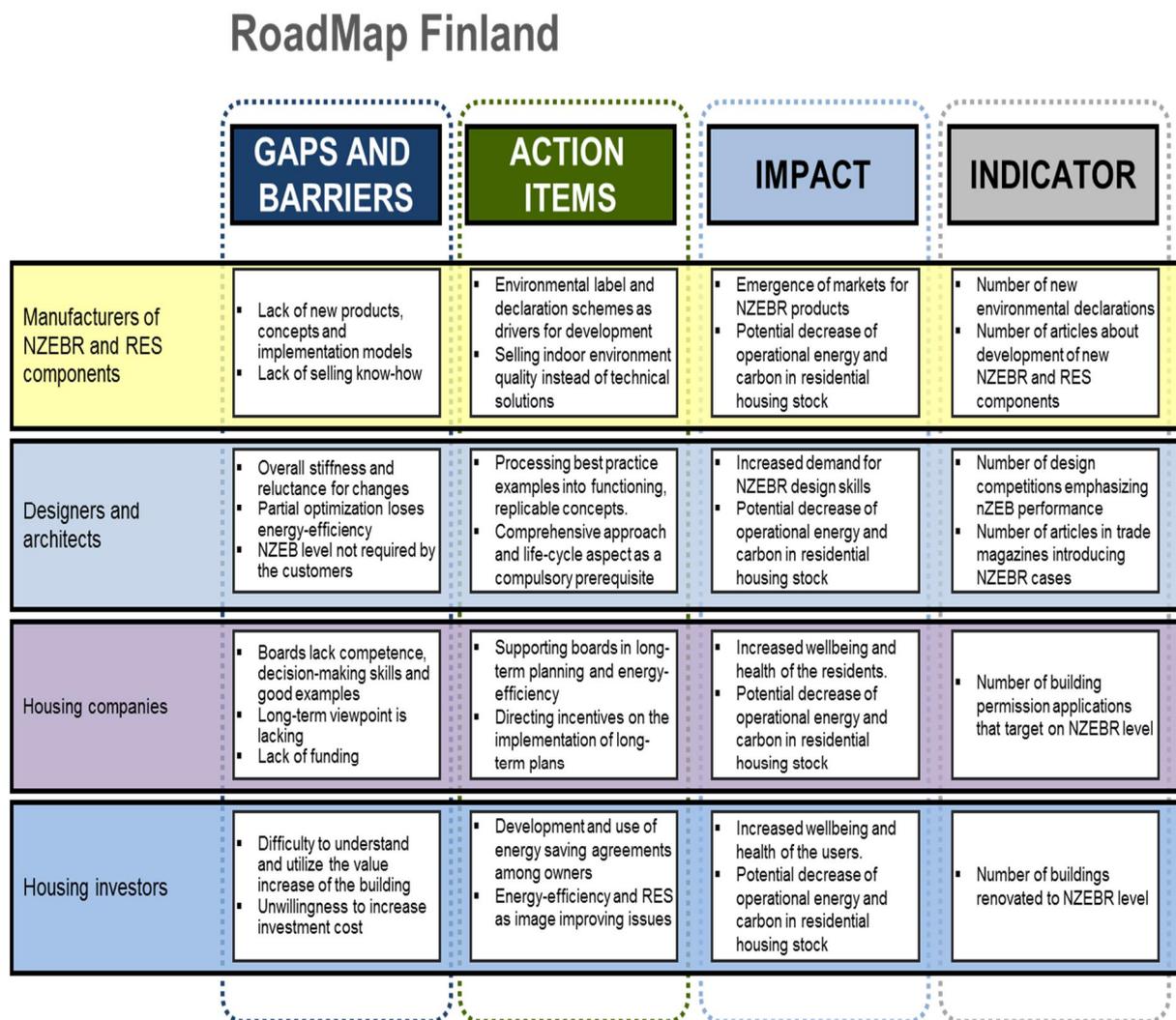


Figure 3. Stakeholder roadmap for Finland

Figure 3 presents the suggested stakeholder roadmap for Finland, based on the main points from the previous chapter. Here the most important action items have been defined for different stakeholder groups. There are altogether eight different actions defined. The central main impact of these actions is a potential decrease or operational energy and carbon in residential housing stock.

The actions defined in the roadmap are further explained in the following taking into account also the previously defined actions from the earlier NeZeR report “Proposal of relevant fiscal incentives and other control instruments for supporting NZEBR”. Also the actors for the actions are here defined.

***Environmental label and declaration schemes as drivers for development***

Energy subsidy which size depends on the level of energy efficiency: Currently the energy subsidy is granted as a percentage of the realized costs of the renovation project. If the size of the subsidy would depend on the energy performance improvement level, the motivation to take up efficient energy saving measures would be higher. Therefore the effect of different renovation solutions in the energy performance must be clear and the environmental labels

and declaration schemes guide customer to choose the best available solutions. The building product industry and organizations have here the actor role.

### ***Selling indoor environment quality instead of technical solutions***

The effect of increasing energy-efficiency into increasing the indoor environment quality needs to be clearly presented. Here the manufacturers, research institutes and universities have a central role and the ministries and decision makers are co-actors in funding the research.

### ***Processing best practice examples into functioning, replicable concepts.***

The best practices and lessons learned from the successful renovation cases should be shared among the renovation professionals and good examples presented to building owners and housing companies. This should be done co-creatively with the renovation industry in e.g. workshops and the actor should take a facilitation role and gather the experiences to concrete guidelines.

### ***Comprehensive approach and consideration of life-cycle aspect as a compulsory prerequisite***

The current building code for renovation requires that energy-efficiency is taken into account in all larger renovation measures. Here the municipal building supervision (building permission authorities) is the actor that is responsible for admitting renovation permits. The renovation solution should be comprehensive and take into account all potentials for energy-efficient renovation. E.g. when the water pipe system is being renewed also the possibility of renewing the ventilation system at the same time should be considered.

### ***Supporting the boards in long-term planning and consideration of energy-efficiency***

Law which makes decision making for housing companies easier: Difficulties to reach the acceptance of the majority of apartment owners in a housing company, which in turn makes it challenging to make decisions about the uptake of renovation measures. The law should be changed in order to enable easier decision making. Here the actors are the decision makers.

Five year plans (sc. PTS) are compulsory for housing companies but the time line should be longer. Boards and their chairs should be encouraged and supported to make long term plans and to always the aspects of energy-efficiency. Housing managers have here an important role. However, they should be supported in order to improve their skills with regard to technological, profitability and social aspects of long-term planning.

### ***Directing incentives on the implementation of long-term plans especially for low-value buildings***

Here the actors are the decision makers.

- Energy subsidy for changing the heating system or implementing renewable energy is at the moment provided only for low income households, who probably do not have the resources to change their heating system or take up energy saving measures. Therefore, the energy subsidy is not very efficient in the current form and the target group should be enlarged to comprise also those households who are the most probable ones to take up energy saving refurbishment measures.
- Domestic reduction for housing companies: Currently only individual apartment owners can receive domestic reduction for renovation measures. Domestic reduction also for housing companies would motivate taking up renovation activities in multi-family buildings.
- State guaranteed loans or energy subsidies directed especially for apartment building refurbishment in periphery areas where the apartments have very low value because of

the decreasing population and therefore decreased demand of housing. This would help these housing companies to get renovation loans from the financing institutes.

***Development and use of energy saving agreements among owners***

When the owner of an apartment or the whole property changes a transfer tax needs to be paid. The size of the tax is a certain percentage of the value of the transaction. This amount could depend on the energy performance level of the building which would motivate the owners to invest in improving energy efficiency.

***Energy-efficiency and RES as image improving issues***

Municipalities and other public actors and owners of buildings should show example and disseminate transparent information about the achieved energy-efficiency levels and other benefits related to NZEBRs. High-level energy-efficiency of renovated buildings and use of RES should be declared for the users of the building.

## 5 ROADMAP IMPLEMENTATION, DEVELOPMENT AND REVISION

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The next phase should be to disseminate the ideas for the roadmaps and launch the roadmaps.

This report suggests key issues and action items for different stakeholders. In Finland the public and private owners of residential buildings, designers and manufacturers are seen as the most important stakeholders.

Many of the suggested action items – such as support for the boards of the housing owner associations – should actually be done by other actors than the key stakeholders themselves. When it comes to the use of the different kinds of steering instruments, municipalities, ministries and policy makers are the key actors.

The aim of this report is to address important issues and items to be done and raise discussion. The Finnish Ministry of Environment and three Finnish cities have been involved in the project and commented the recommendations. The results have also been presented in final seminars of NeZeR in Finland. However, this roadmap is an initial proposal and further discussion and planning is needed to implement and further develop the ideas of the roadmap.

## 6 CONCLUSIONS

The following figure summarises the identified gaps, barriers, action items, impacts and indicators for different important stakeholders in NZEBR.

