

E2 ReBuild

Industrial Energy Efficient
Retrofitting of Resident
Buildings in Cold Climates



D3.3 Evaluation of Case Studies and Demonstrations with the focus of Added Values

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Executive Summary

Retrofitting a residential building presents the opportunity to generate values for a broad range of stakeholders. The choices made regarding physical and collaborative aspects throughout a retrofit, all impacts the retrofit process and its physical outcome. Using experiences made from the E2ReBuild demonstration projects, through the involved stakeholders, this report highlight values generated by the respective retrofit, with a focus on social values.

By adopting a socio-architectural focus, highlighting increased social values experiences by the tenants, complex value chains set in motion by a retrofit was unveiled.

A framework for measuring and graphic visualization of value generation from a tenant perspective was developed through qualitative interviews and implemented by a tenant questionnaire, resulting in social impacts experiences by the tenants caused by the changed living environments generated by the retrofits.

Added values could be identified through contextualising social impacts in relation to other increased values such as economic and ecological. Added values is thus defined as values generated by the retrofits, having a positive social impact while at the same time leading to increased values for other stakeholders.

Measures to reduce energy consumption and the cost of heating have a direct impact on the ecologic footprint of a building. But these measures can at the same time have a positive impact on the experienced quality of life for the tenants of the building. This report shows examples of how tenants experience an increased quality of life through measures which also decreases the buildings energy consumption while at the same time generates long term monetary profitability.

The report also shows how essential information and communication are to realise the potential in generating positive social impacts. A retrofit has the potential to generate but also decrease social values, given the ambition invested in information and communication towards tenants. Participation is not necessarily the key aspect, but understanding the needs of the tenants and keeping them informed, throughout the retrofit. Experiences from the E2ReBuild demonstrations show how the lack of communication and information causes distress for tenants, which has a direct impact on their quality of life through the loss of control in their daily life. Examples also show how proper information and inclusive communication channels during a retrofit can generate an increased sense of community between tenants.

A socio-architectural method is presented as a means to increase the potential to generate added values through a retrofit. The key aspect is not to give advice on physical measures but to increase the understanding of how physical measures and the process of their design, production and implementation can generate positive social impacts.

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Contributions

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Information from experts within the E2ReBuild consortium and external stakeholders, mainly building on the experiences from the demo projects, have been an equally important source of insights, through which this report builds its analysis and evaluation.

The tenants, experts within the consortium and external stakeholders have contributed through conducted interviews, workshops, questionnaires and stakeholder meetings.

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1 Introduction

Today the building industry in Europe is mainly characterized by on-site production, which may be inefficient with regard to costs and production time. Facing the demand of reduced energy consumption and the renovation of buildings constructed between 1945 and 1980 industrialized renovation methods and advanced renovation processes are urgently needed. Using well-designed, prefabricated elements can drastically reduce the production time and thus possibly also costs for renovation projects, while minimising social disturbance for tenants. The vision of E2ReBuild is to transform the retrofitting construction sector from the current craft and resource based construction towards an innovative, high-tech, energy-efficient industrialised sector.

1.1 Interest and Motivation

The *Europe 2020 strategy*¹ and the recent EC staff working document *Progress on GDP and beyond actions*² indicates, from the European policy level, the need to bring aspects such as social cohesion, social innovation and local participation at the core of smart growth and sustainable development. Focusing more explicitly on sustainability within the realm of urban development the Leipzig charter states that a holistic approach, emphasizing an integrated and collaborative interaction between stakeholders, a strong participation at the local level and measures to incorporate social sustainability, is essential in order to reveal the potential of European cities in terms of cultural and architectural qualities, social integration and economic development.³

Retrofitting the large stock of European residential buildings, originating from the decades after WWII, present many challenges as the socio-economic context often is characterized by low income levels, unemployment and a lack of social capital. Weak linkages and connectivity to surrounding areas and city centers are examples of spatial structures depicted as increasing the problems in these areas.⁴ Although these aspects mostly target urban regeneration schemes rather than individual building retrofits, which are the main focus of E2ReBuild, the ambition of this report aims to relate social value increases to the retrofit process and its physical outcome.

Building on an increased understanding of the social impacts from a tenant perspective will in the report lead to a discussion on added values and methods to incorporate this multi stakeholder value generation in a retrofit process.

The building- and planning sector are gaining momentum in terms of integrating social- and behavioural aspect in a strive to understand and implement social sustainability. Planning, building and renovating to create as good living environments as possible is of course not a new tendency, but a growing framework for implementing and assessing social aspects are broadening the scope of sustainability work within the planning and building sector. In a study of the development of social sustainability metrics and indicators from the 1970s onwards Andrea Colantonio concludes that previous indicators have had a focus on basic needs while the present development includes more generative and institutional aspects such as governance, representation, inclusiveness and that purely statistics-based indicators are complemented by more qualitative sets of indicators and methods to measure and assess them.⁵

¹ European commission (2010), Europe 2020 – A strategy for smart, sustainable and inclusive growth.

² European Commission (2013), *Progress on 'GDP and beyond' actions*.

³ Federal Ministry of Transport, Building and Urban Development, Germany (2012) *5 Years after the LEIPZIG CHARTER – Integrated Urban Development as a Prerequisite for a Sustainable City*.

⁴ Wassenberg et al (2007) *Strategies for upgrading the physical environment in deprived urban areas*. European Urban Knowledge Network.

⁵ Colantonio, Andrea (2007) *Social sustainability – linking research to policy and practice*.

Following this tradition this deliverable will highlight the needs of tenants and the impact a retrofit has on their life and well-being. By measuring the effect of the E2ReBuild retrofits through a set of indicators, key insights will be unveiled regarding the social implication of a retrofit and potential value changes.

1.2 Aims, Objectives and Limitations

A key feature of the E2ReBuild approach implies balancing technical, economic, ecologic and social aspect within a holistic view of a retrofit process. This report and the work having been carried out in the task of 3.2 stresses the importance of understanding the social aspect of a renovation. Within the framework of a building renovation this involves: understanding the needs, behaviour and visions of the tenants. Building on qualitative data gathered through in depth interviews with tenants and other stakeholders, participation at tenant- and stakeholder meetings and quantitative data gathering through tenant questionnaires, this deliverable will mainly describe experiences from tenants of the E2Rebuild demonstration projects. The gathered data emphasizes both the tenant's role and experience of the process and their experience of the physical outcome; the finished retrofit solution.

While other deliverables emphasize describing and evaluating technical solutions, stakeholder collaboration, economic models, environmental impact and building form and typology the key outcome of this deliverable is to generate an understanding of the social impacts of the demonstration projects through highlighting the experience of the tenants. The motivation for this focus is harmonising with the potential of a retrofit to generate increased social values such as well-being, proudness, local identification and inclusion and decreased discomfort, stress and exclusion.

The main aim of the research conducted in the task is to strengthen the understanding of added values generated by a retrofit with a bearing on social impacts. By using the experiences of the demos within E2ReBuild, added values created from mainly a tenant perspective can be related to values created in reference to other aspects which have been highlighted within E2ReBuild. Following a holistic approach the findings will be contextualised with reference to value chains affecting other stakeholders and aspects with a bearing on values outside the social realm.

Given the focus on industrialised methods for energy efficient retrofitting of residential buildings, within E2ReBuild, the focus in the report is not on use and design of: public spaces, green areas, commerce or mobility and movement. Our focus is mainly on the process and impact of a residential building retrofit and not the area outside of it. The evaluation conducted in regards to the work in the 7 demonstration projects should further not be viewed as a social impact assessment, as this would imply following and assessing a wider set of criteria and indicators.

1.3 Key Questions

- How can a residential retrofit be evaluated from a social perspective?
- Which social impacts did the E2ReBuild demonstration projects create from a tenant perspective?
- How do the targeted social impacts correlate with value chains affecting other stakeholders?
- How can added values be strengthened in future retrofit projects?

1.4 Methodology

1.4.1 Bottom up Approach and Socio-architectural Focus

Existing buildings are living quarters which have their use, inhabitants, identity and atmosphere. Any renovation changes the buildings technical and physical structure and will have a great impact on the

daily life of its inhabitants. It is therefore essential that the perspective of the tenants is reflected in all stages of a renovation. The socio-architectural approach emphasizes the role of the tenants in a renovation process.

Crucial aspects are: Strategies to incorporate needs and wishes of tenants in the early stages of the renovation process, possibility to influence the outcome of the renovation, information to tenants before and during renovation, handling of disturbances during renovation and handling of claims during renovation.

The socio-architectural approach also aims at mapping the role of the *tenants' relation to other stakeholders*. The approach emphasizes how the tenants' needs are integrated in the work being carried out by other stakeholders and how it reflects the renovation planning and outcome.

The adopted methodology incorporates both qualitative and quantitative data gathering strategies. Qualitative field studies have been carried out in Voiron and Halmstad where tenants of the E2ReBuild demonstration projects and other stakeholders have been interviewed. Through a tenant questionnaire distributed to all demonstration projects a broader empirical base was captured. The key aspect is using a bottom up approach, building the analysis on the experiences of the stakeholders involved in the demonstrations and the evaluation of its outcome through the tenant questionnaire.

1.4.2 Ethnographic Field Studies

Ethnography is widely used as a scientific method in various fields, both academically and professionally. Ethnographic methods are usually qualitative and consist of a broad set of methods focusing on understanding individual experiences, mainly through interviews and participant observations.

Ethnographic field studies have been carried out in Voiron and Halmstad during the project. In Voiron tenants have been interviewed in their homes, with the help of a translator. In depth interviews were made with 7 tenants during the spring of 2012. The field study also consisted of in depth interviews with the supervising architect, the tenant officer from the building owner (Opac38) and the facility caretaker. Participation at a weekly tenant meeting and a weekly working meeting was also carried out in Voiron. At the spring of 2012 the renovation in Voiron was ongoing.

In Halmstad a walk through analysis was made in the autumn of 2011. During this event, 2 tenants, representatives from: the building owner, the main contractor, the municipal planning agency, the municipal political planning body and the county planning agency participated. During this walk through analysis the above mentioned stakeholders together walked in the area surrounding the demonstration project and also visited one of the apartments and at a later stage had a common discussion on topics related to the renovation project. In Halmstad a total of 10 tenants were further interviewed through shorter semi structured interviews during the autumn of 2011, when the renovation was in progress.

The field studies carried out in Halmstad and Voiron emphasized analysing the role of the tenants in the renovation process: how they were involved, their expectations and experiences of the ongoing renovation.

The motivation for choosing these two demonstration projects was to be able to get a deeper understanding of the value generation from a tenant perspective. The two projects have similarities in terms of location within the city, number of tenants and building structure and outline. However, both the adopted retrofit process and its physical manifestation varied greatly, making it an interesting comparison.

1.4.3 Quantitative Survey Method

A tenant questionnaire was produced and distributed to all demonstration projects. The aim of the questionnaire⁶ was to evaluate the renovation from a tenant perspective and to get insight on more general attitudes on participation, inclusion and energy behaviour.

The situation before and after was compared through the following aspects:

- Well-being and health (indoor comfort and equipment standard)
- Experience of the built environment (proudness, quality of life, security)
- Evaluation and use of technical systems (heat and ventilation control)
- Architectural quality (of floor plan and room design)

For an evaluation of the renovation process and on more general issues concerning involvement and attitudes toward energy behaviour the following aspects was covered:

- Retrofit design and process (participation and information during retrofit, value of retrofit)
- Collaboration and participation (involvement in decision regarding house/apartment)
- Energy behaviour (awareness and interest in energy behaviour and willingness to change)

The questionnaire consisted of both open questions, where the tenant could write their own answers and check-box questions.

1.4.4 Outline Work Process

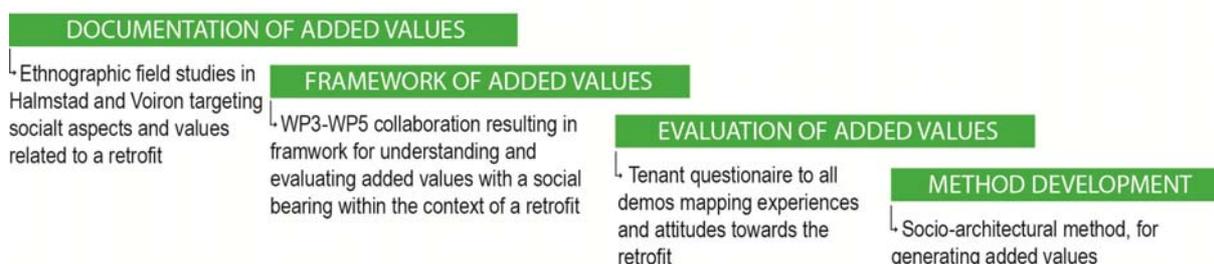


Figure 1: Outline work process task 3.2



Figure 2-4: Tenant interview, Halmstad, walk through evaluation, Halmstad, weekly tenant meeting, Voiron

1.5 Theoretical Framework

The ambition of this report is not to elaborate on theoretical issues regarding the definition of social sustainability or the social value chains. Rather, which has been highlighted above and also in Deliverable 3.1⁷; to adopt a bottom-up approach and use experiences made at the demonstration

⁶ The English version is found in the appendix A

⁷ "Evaluation of collaboration models", available at: <http://www.e2rebuild.eu/en/links/deliverables>

projects. Although, a brief basic theoretical ground needs to be built in order to contextualise and motivate later findings and conclusions.

1.5.1 Framework of Added Values and Social Impacts

There are numerous potential stakeholders and values to target for describing value chains set in motion by a retrofit. Following a holistic approach the concept of an added value is targeting value chains affecting several stakeholders, within the framework of residential building retrofitting. The main focus of this report is however, to unveil values generated from a tenant perspective, but linking these to increased values for the owner, subcontractors, architect etc targets the concept of added values.

In order to frame and dissect the potential social values influenced by a retrofit a framework of underlying aspects and indicators to measure them was developed. The fieldworks conducted in Voiron and Halmstad was a key methodology for this work, in combination with collaboration among partners within E2ReBuild. The interviews conducted with tenants in Halmstad and Voiron uncovered values and deficiencies before the retrofit, aspirations and worries regarding the retrofit and to some extent also covered experiences of the retrofit as some of the tenants inhabited apartments in which renovation had begun. Experiences from these interviews will be further elaborated under section 3.

Social sustainability has struggled to gain the same theoretic legitimacy, as the two other commonly used pillars of sustainability: economic and ecological. Several definitions have been used since the concept was introduced during the early 1970s, without finding an agreed upon common ground. On a general level the concept and the indicators of which it is contextualised have moved from measuring and targeting basic need to a more generative framework of collaboration, inclusiveness and social capital.⁸

The aspects included in the listed framework can be seen to represent both a traditional definition of social sustainability, focusing on basic human needs such as indoor comfort, access to natural light and security, but also on a more contemporary definition including inclusiveness, participation and identification.

The ambition of the framework is to cover a broad range of indicators which together forms a basis for evaluating the social impact of a retrofit. The fieldwork conducted in Halmstad and Voiron⁹, through which tenant experiences were collected, proved a key methodology to target aspects and indicators which had a strong influence on the well-being of tenants and their aspirations/concerns about the retrofits.

The complete framework for evaluating social values is listed below in figure 5.

⁸ Colantiono et al (2009) *Measuring social sustainability – Urban generation in Europe*. Oxford Institute for Sustainable Development.

⁹ Some tenant interviews were also conducted at the London demo to expand the fieldwork experiences from Halmstad and Voiron.

Framework for evaluating social impacts	
Aspect	Indicator
Well-being and health	<ul style="list-style-type: none"> - Access to natural light - Noise protection (from within building) - Noise protection (from outside building) - Summer temperature - Winter temperature - Exterior wall indoor surface temperature - Draught from windows - Air quality (particles of dust and dirt) - Air quality (smell) - Indoor moisture/humidity - Kitchen equipment standard - Bathroom equipment standard - Overall indoor comfort
Experience of the built environment	<ul style="list-style-type: none"> - Quality of life is high in my apartment/house - Quality of life is high in my building - Quality of life is high in my neighbourhood - I'm happy with my apartment/house size - I'm happy with my building size - I feel safe in my apartment/house - I feel safe in my building - I feel safe in my neighbourhood - I feel proud of my apartment/house - I feel proud of my building - I feel proud of my neighbourhood - The status of my neighbourhood is high - Where I live is important for my identity - My apartment is important for my identity - I feel a strong connection to where I live now - I belong to the community in my neighbourhood
Architectural qualities	<ul style="list-style-type: none"> - Floor plan design in your apartment/house - Materials and surfaces - Windows - Light condition - Kitchen - Bathroom - Toilet - Living room - Bedroom - Floor plan design of your building - Balcony - Staircase - Elevator - Building roof - Building facade - Building entrance - Storage closet - Communal sauna - Laundry - Club room
Information, communication and value of retrofit	<ul style="list-style-type: none"> - Communication before retrofit - Information distributed about the retrofit - Participation from tenants in the design phase - The suggested design proposal - Work in the apartment during retrofit - Value of retrofit in relation to rent level - Overall impression of retrofit process - Overall impression of retrofit outcome (the design) - Information to correctly use heating and ventilation system
Energy behaviour¹⁰	<ul style="list-style-type: none"> - Is your energy use an important aspect for you? - Are you aware of your energy use? - Are you interested in reducing your energy use? - Would it be possible for you to reduce your energy use? - Has the retrofit made you more aware of your personal energy use?

Figure 5: Framework for evaluation of added values

¹⁰ These aspects will be further elaborated within Deliverable 5.4 and 5.5.

2 Added Values from a Process Perspective – In Depth Analysis of Halmstad and Voiron Demo Projects

This section mostly explores added values from a process perspective. The analysis is based on the qualitative field work conducted in Voiron and Halmstad. Through interviews with tenants and other stakeholders and participation at stakeholder meetings the aim is to give an in depth description of participation between tenants and other stakeholders and the added (or decreased) values generated through the retrofit.

Following the ethnographic methodology adopted during the field work, the analysis gives a voice to the tenants and stakeholders participating in the respective retrofit. Their expectations, motivations and experiences form the basis of the analysis.

Initially some basic facts regarding the demos, focusing on the involvement of the tenants, will be described. Deliverable 3.1 gives a more thorough description on the collaboration schemes adopted at the seven E2ReBuild demonstration projects.

The purpose of the fieldwork was further to use the understanding of the tenant's situation as a basis for forming the framework of the evaluation of social impacts, used within the questionnaire later distributed to all demos.

2.1 Setting the Stage – Outline of the Halmstad and Voiron Demonstration Projects

2.1.1 Halmstad



Figure 6: Demo Halmstad before
(Source: HSLU)



Figure 7: Demo Halmstad after renovation
(Source: NCCSE)

Tenants were informed about the renovation through an information meeting held by building owner Apartment Bostad and written information was distributed to all tenants. Focus was on information rather than participation although some options were given regarding for example kitchen equipment. A test apartment was constructed to give tenants the opportunity to see the outcome. Rent level was negotiated between the tenant association¹¹ and Apartment Bostad. 95 percent of tenants agreed to the terms, which is a high number for the Swedish renovation market. The other 5 percent rejected the terms negotiated and made an appeal to the Swedish Courts Administration, the appeal was however rejected. 100 percent approval is needed according to Swedish law, but appeals made by the tenant association are extremely rarely approved. During the renovation the total contractor NCCSE was in charge of handling complaint from tenants. A representative from NCC was stationed at the site in order to communicate with tenants.

¹¹ Hyresgästföreningen

2.1.2 Voiron



Figure 8: Demo Voiron before
(Source: OPAC38)



Figure 9: Demo Voiron after renovation
(Source: Berne Architecte)

A tenant questionnaire was distributed by the owner Opac38 as a first step in the renovation process, to identify the needs and wishes of the tenants. This formed an input to a first draft of a work program developed in collaboration between Opac38 and the architect Berne Architects. During the initial tenant meeting the survey was presented along with the suggested work program, which was further discussed between tenants, owner and architect. A second tenant meeting followed at which a revised version of the work program was presented to the tenants, followed by a negotiation of its final form. An agreement was further distributed among tenants, for them to sign. 70 percent signed the agreement. 50 percent or more needs to sign. During the renovation, weekly tenant meetings were held on site at which a tenant representative of Opac38 and the supervising architect attended. A test apartment was constructed prior to the retrofit, in which the tenant meetings were held and through which the tenants could get an idea of the scope of the retrofit. Handling claims were the responsibility of the tenant representative from Opac38 who was in close contact with the architect who also functioned as site manager.

2.2 Role of the Tenants and Enabling the Identification of Added Values

The Voiron and Halmstad demo manifested two different strategies in relation to the involvement of the tenants. While Apartment bostad had a stronger claim of in house knowledge of the tenants needs and wishes, Opac38 adopted a more inclusive process of a stronger tenant involvement. The tenant questionnaire that was distributed in Voiron at an early planning stage enabled the stakeholders representing the owner to identify aspects which tenants felt were most anticipated. During the fieldwork conducted in Voiron tenants had strong complaints about the cold indoor climate and the lack of central heating. Tenants had to pay for their own indoor heating through individual heating devices, as shown on figure 10 and 11 below. This aspect was brought up also in the questionnaire and enabled the owner to communicate the installation of collective heating as a strong increased value which would have positive comfort and economic effects for the tenants. Although this aspect might have been part of the retrofit even without tenants wishing for it, communicating that the owner had listened and reacted upon the tenant's opinions, built trust within the process between tenants and the owner.



Figure 10: Tenants in Voiron showcasing individual heating devices.

2.3 Stakeholder Collaboration and Information Sharing

Interviewed tenants from both demos agreed to the need of good communication channels before and during a retrofit, to avoid stress and a situation where tenants are surprised by actions taken by other stakeholders involved in a retrofit. Not knowing what will happen, not knowing who is responsible and not knowing who to contact were aspects brought up by tenants as key questions for the owner to target with information, communication and a transparent collaboration process with clear responsibilities.

Creating communication channels between tenants, building owner and key stakeholders is essential throughout the entire planning and construction process. It makes tenants feel that they have the situation somewhat under control even though the retrofitting process touches the base of their security and comfort. Whereas lack of communication generates a lack of trust and increases stress. Trust between neighbours as well as between neighbour and building owner – often referred to as social capital – has the potential to be increased through the retrofit process. Interviews with tenants in Voiron showed that an inclusive retrofit process, where tenants could meet weekly with the building owner and supervising architect, generated an increased communication between neighbours as well as a sense of togetherness. Tenants got to know each other through the retrofit process.

“Most of the people live in different sections in the building don’t really know each other, they leave in the morning, they come home, they sleep but during the tenant meetings they got to know each other” (Male, Supervising architect, Voiron)

“We have meeting every Thursday and I go every Thursday. It was only last Thursday that I missed the meeting since I wasn’t here. We are informed about the progress and the renovation. Definitely well-informed. I don’t really mix with the others tenants. I know them, they are nice, but I don’t mix, it’s really only at the meetings that I speak to them.” (Female, tenant, Voiron)

From the building owner’s perspective it was further very positive that tenants who attended the weekly meetings spread positive feedback to tenants not attending. Also, that during the meetings

“negative” and “positive” tenants would meet and confront opposing opinions without the owner necessarily intervening. Having a clear sense of who is responsible and who is accountable was another positive aspect which came out of the weekly meetings.

“I, in the project, is a representative of the owner. I represent the authority. I’m supposed to have power, which I don’t have in sense, but in people’s minds I have power. So I’m the power person. I become the guilty one. All the negative energy during the construction process goes towards me.” (Male, tenant manager, building owner, Voiron)

“A meeting I had. There was this lady who was especially known to be especially negative. When we went into the meeting, I went and sat beside him. My director was saying ‘Jean Louis, what are doing?’. I said ‘no she’s not going to bite me’. What was fantastic yesterday, was that this man, the negative man, started spewing out his criticism and everything that he was opposed to. But then there were the other tenants, were looking at him and saying ‘no, no, you’ve got all wrong and we can’t accept your reaction and aptitude.” (Male, tenant manager, building owner, Voiron)

Listening to tenants describing their relation with the owner of their apartment and their reaction to the renovation it is clear that a renovation starts long before the actual renovation plans are communicated to the tenants. The reaction by the tenants can be seen as contextualized by the history of trust, or the lack of it, produced and reproduced by actions and communication the years before the renovation.

“I have always appreciated the service that was provided by OPAC. That was why I said yes right away, and this building does need some rejuvenation.” (Female, tenant, Voiron)

2.4 Depth of Participation – Risk and Opportunity

Listening and giving a voice to tenants always comes with the potential of not being able to accommodate and for building expectations not fulfilled. Tenants are never homogeneous in their opinions and wishes. But, opinions and wishes will not diminishing by not giving them space within the process. Tenants create their own informal discussion clubs and claim management departments, among themselves, with the risk of false rumors spreading and contaminating the process. Several stakeholders have, during the course of the E2ReBuild project, expresses fear of giving tenants power and a voice within the retrofit process, motivated by them not having professional competence and to create expectations not being able to be accommodated and to unveil disagreements between tenants. Tenants themselves are further expressing these kinds of fear of tenant participation and the difficulties surrounding tenant meetings.

“It’s better if they don’t give that chance. Everyone would have given their point of view and it would have been a mess. It’s better to let the professionals do that. It would have been too many opposing views to achieve something positive.” (Male, tenant, Voiron)

“I was at the information meeting but it’s difficult to get a saying with all the people” (Female, tenant, Halmstad)

3 Evaluation of the Demos by Mapping Social Impacts

The following section describes social impacts generated by 6 of the E2ReBuild demonstration projects, from the tenant perspective. The means for the analysis is the tenant's experience of the retrofit process and its impact. The evaluation targets material aspects such as evaluation of before and after standard/equipment of apartment/house as well as immaterial values such as proudness, security and local attachment. The situation before and after are compared under the aspects of *Well-being and health*, *Experience of the built environment* and *Architectural quality* while the aspects *Information, communication and value of retrofit* are evaluated without time comparison.

The basis of the analysis was a tenant questionnaire that was distributed within all demos, except London which was still under renovation at the time of having to finalise the evaluation and the Deliverable.

3.1 Means of Distribution at each Demo

Means of distribution and answering rate, tenant questionnaire	
Augsburg	Printed questionnaires were sent out to all demo households, 10 months after finished renovation. 23 out of 60 households answered the questionnaire. The questionnaire consisted of both before and after evaluation. The questionnaire was distributed and collected during February-March 2014.
Halmstad	Printed questionnaires were sent out to all demo households 12 months after finished renovation. 28 out of 71 households answered the questionnaire. The questionnaire consisted of both before and after evaluation. The questionnaire was distributed and collected during November-December 2013.
Munich	Printed questionnaires were sent out to all demo households, 10 months after finished renovation. 18 out of 46 households answered the questionnaire. The questionnaire only evaluated the after perspective, given that the demo was evicted prior to the renovation. The questionnaire was distributed and collected during February-March 2014.
Oulu	The demo consists of 8 apartments in a two-storey student accommodation building. Before renovation 3 phone interviews and 2 personal interviews were conducted in July 2012. The after perspective was gathered through an electronic questionnaire distributed by email to 4 households in March 2014. These were the only households resident in November 2013 - March 2014.
Roosendaal	Interviews based on the questionnaire were conducted by personal visits at 7 out of 70 demo households, in March 2014. The interviews consisted of both before and after evaluation.
Voiron	Interviews based on the questionnaire were conducted by phone. A total of 10 phone interviews was conducted in February 2014. The interviews consisted of both before and after evaluation.
London	The London demo was still under renovation, April 2014, when the deliverable went into review, hence this demo is excluded from the evaluation.

Figure 11: Summary, means of distribution and answering rate tenant questionnaires.

3.2 Framework for Evaluation

Framework for evaluating social impacts	
Aspect	Indicator
Well-being and health	<ul style="list-style-type: none"> - Access to natural light - Noise protection (from within building) - Noise protection (from outside building) - Summer temperature - Winter temperature - Exterior wall indoor surface temperature - Draught from windows - Air quality (particles of dust and dirt) - Air quality (smell) - Indoor moisture/humidity - Kitchen equipment standard - Bathroom equipment standard - Overall indoor comfort
Experience of the built environment	<ul style="list-style-type: none"> - Quality of life is high in my apartment/house - Quality of life is high in my building - Quality of life is high in my neighbourhood - I'm happy with my apartment/house size - I'm happy with my building size - I feel safe in my apartment/house - I feel safe in my building - I feel safe in my neighbourhood - I feel proud of my apartment/house - I feel proud of my building - I feel proud of my neighbourhood - The status of my neighbourhood is high - Where I live is important for my identity - My apartment is important for my identity - I feel a strong connection to where I live now - I belong to the community in my neighbourhood
Architectural qualities	<ul style="list-style-type: none"> - Floor plan design in your apartment/house - Materials and surfaces - Windows - Light condition - Kitchen - Bathroom - Toilet - Living room - Bedroom - Floor plan design of your building - Balcony - Staircase - Elevator - Building roof - Building facade - Building entrance - Storage closet - Communal sauna - Laundry - Club room
Information, communication and value of retrofit	<ul style="list-style-type: none"> - Communication before retrofit - Information distributed about the retrofit - Participation from tenants in the design phase - The suggested design proposal - Work in the apartment during retrofit - Value of retrofit in relation to rent level - Overall impression of retrofit process - Overall impression of retrofit outcome (the design) - Information to correctly use heating and ventilation system
Energy behaviour	<ul style="list-style-type: none"> - Is your energy use an important aspect for you? - Are you aware of your energy use? - Are you interested in reducing your energy use? - Would it be possible for you to reduce your energy use? - Has the retrofit made you more aware of your personal energy use?

Figure 12: Framework for evaluation of social impacts

3.3 Interpretation and Validity of Data

Each of the indicators listed in figure 10 represents a question within the questionnaire. The tenant, when answering the questionnaire, was asked to evaluate each indicator on a scale from 1 to 6, where 1 represents the lowest score and 6 the highest. In the below analysis each aspect, for each demo, is forming a value diagram in which all indicators are evaluated, before and after. When interpreting the data the score 1-3 represents not pleased/not positive, 4-6 represents pleased/positive. The evaluation of each indicator is done by summing up the percentage of tenants that are pleased/positive with this particular indicator, for example “access to natural light” or the “floor plan design of apartment”.

The choice of this method for summarising the results was motivated by reducing the impact of an individual answer in the overall evaluation of each indicator.

Given the variety of respondents, from 4 in Oulu to 28 in Halmstad, a consequence of the variety of number of households in the different E2ReBuild demo projects, the below presented statistics should be interpreted with great care. The validity of the results can be questioned by the variety in answering rate and the different means of collecting the data. The questionnaire in Halmstad, Augsburg, Munich and partly in Oulu was done by a printed questionnaire giving the tenants more time to fill in and reflect on the answers. In Roosendaal, Voiron and partly in Oulu¹² the interviews was conducted by phone or personal interview, giving the tenants less time to think about their answers and possibly they further feel less inclined to be critical. Although, the questionnaires gave insights that should not be neglected or underestimated, as they represents the experiences made by the people living at the centre of the renovations, forming their lives around it and suffering or benefitting from the changes the renovation undeniably causes.

In all demos except Oulu the evaluation of the before and after situation was done after the renovation, within the same questionnaire/interview. In Oulu it was, within the time frame of the E2ReBuild project, possible to interview the tenants living in the dwellings before and after which was done because the tenant stock would change. The motivation for evaluating before and after within the same questionnaire/interview at the other demos was to collect the personal experience and comparison of the before and after situation.

Included in the questionnaire was “free text boxes” allowing the tenants to comments on the aspects more freely. In the summary of each demo evaluation theses answers have been included. Some quotes by tenants will be used when motivated by reappearing opinions and also to give room for more personal reflections and experiences made by the tenants.

The summary which ends each demo evaluation focuses on highlighting indicators where strong changes have occurred in comparison before and after. Motivation for these changes will also be made, with reference to comments from tenants.

For further reading regarding the demonstration projects; Deliverable 3.1 describes and evaluates adopted stakeholder collaboration models (also including the tenants involvement), Deliverable 4.2/3 describes adopted technical systems and Deliverables under work package 2 (D2.1-D2.7) gives a full description of each demo retrofit.

¹² the Before evaluation in Oulu was done by verbal interview (3 over telephone, 2 in person in the tenant's homes)

3.4 Results of demo evaluation through graphical data adaptation

3.4.1 Evaluation of Augsburg, Germany

Well-being and health:

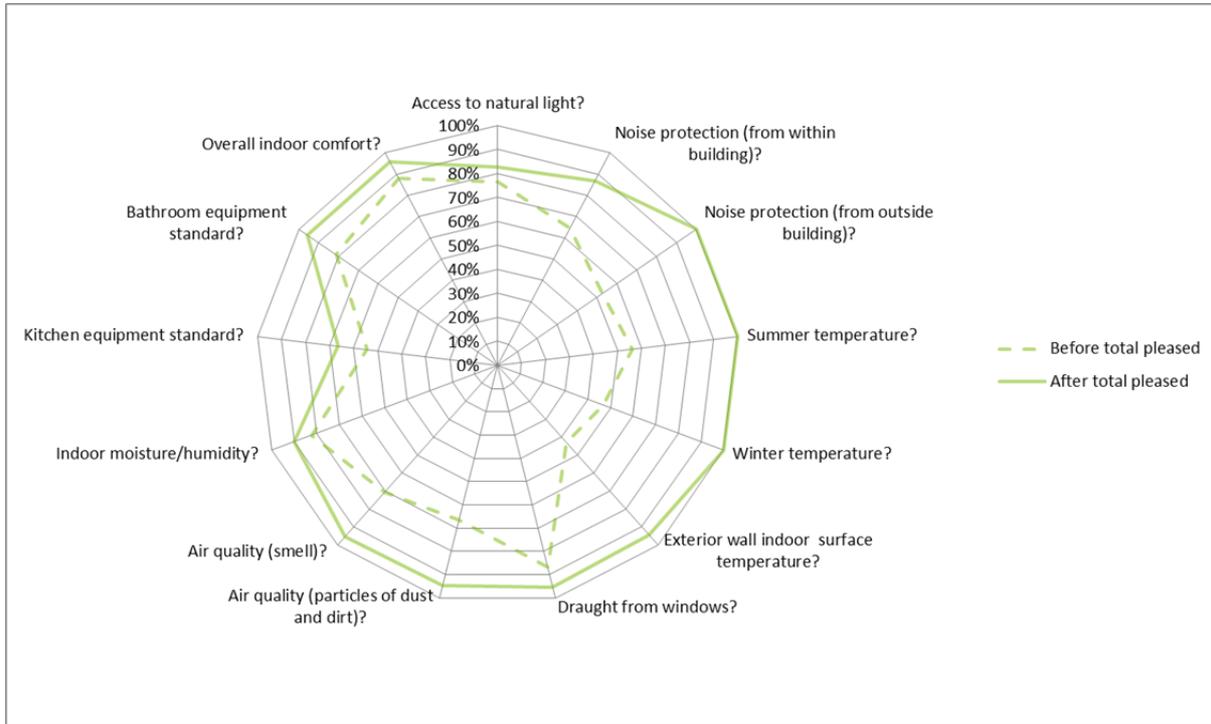


Figure 13: Evaluation of *Well-being and health* before and after retrofit, Augsburg.

Experience of the built environment:

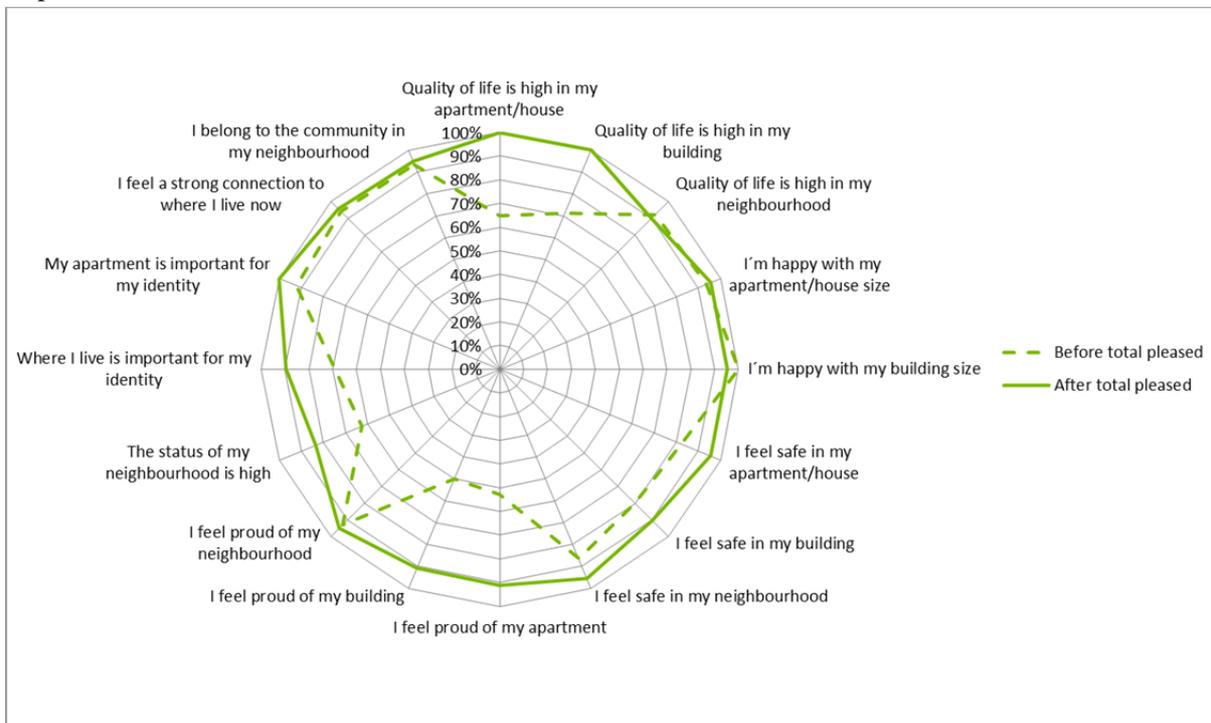


Figure 14: Evaluation of *Experience of the built environment* before and after retrofit, Augsburg.

Architectural quality:

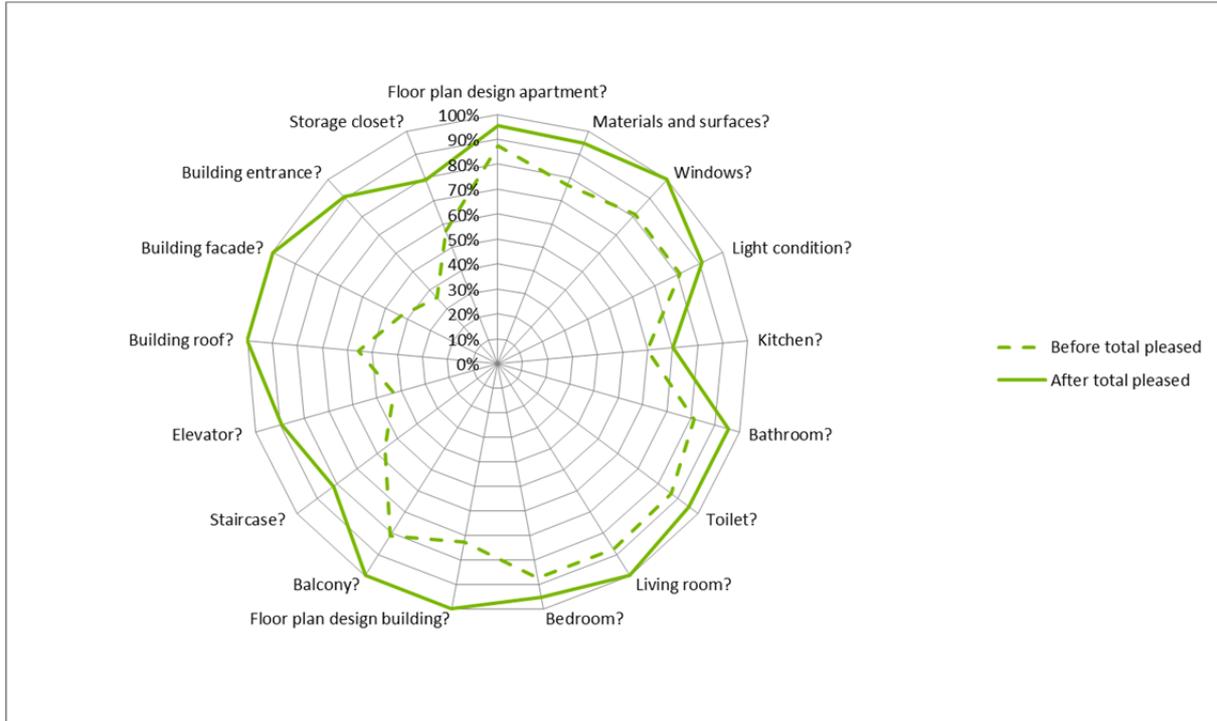


Figure 15: Evaluation of Architectural quality before and after retrofit, Augsburg.

Information, communication and value of retrofit:

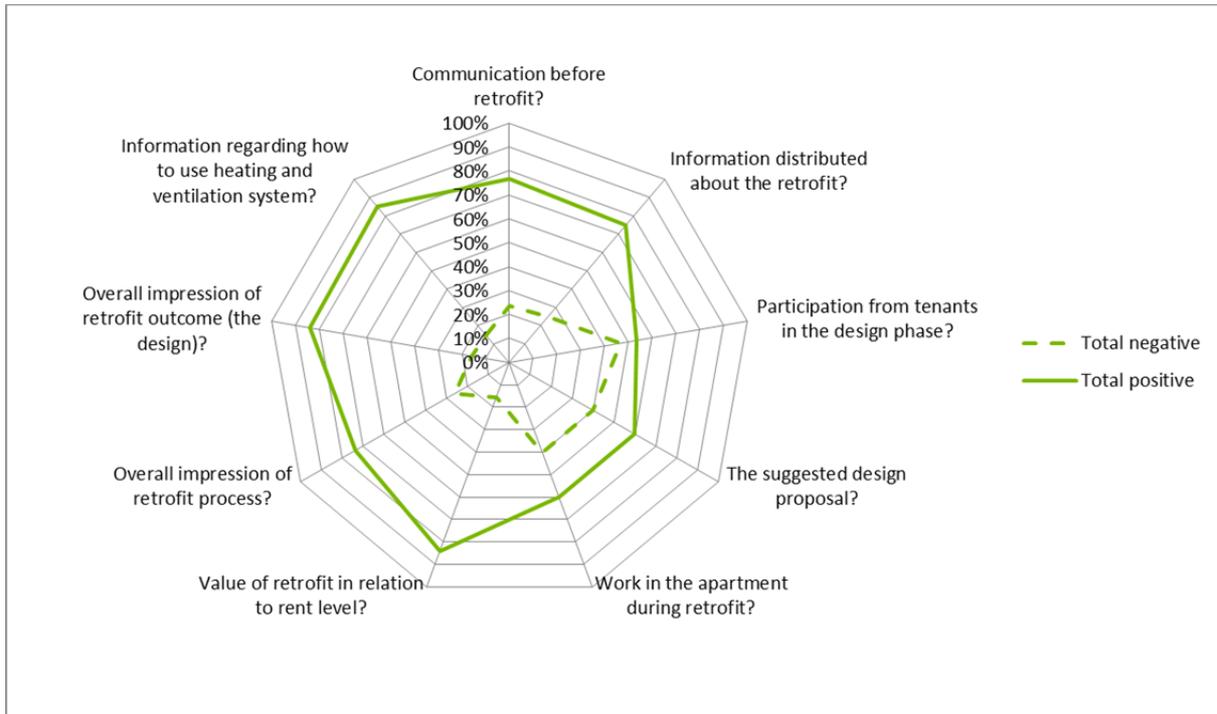


Figure 16: Evaluation of Information, communication and value of retrofit, Augsburg.

Summary evaluation of evaluation – Augsburg	
Aspect	Positive social impacts
Well-being and health	Strong increase in indoor comfort, air quality (dust and smell), noise protection and both summer and winter temperature. <i>“New living comfort (central heating)”</i>
Experience of the built environment	Strong increase in proudness of both apartment and building and the perceived quality of life in both building and apartment. To a smaller extent also an increase in already high value for status of neighbourhood. Several tenants comments on the improved appearance of the building and that quality of life is related to this factor. But also comments regarding accessibility was mentioned: <i>“The barrier free access is very important to us, as my wife is disabled!”</i> <i>“Very good access with rollator!”</i>
Architectural qualities	Overall a strong increase in perceived architectural qualities, especially exterior indicators such as building façade, and entrance.
Information, communication and value of retrofit	Overall strong positive reactions, also from the written comments from the tenants, towards information and communication and the final retrofit solution. <i>“Well done”</i> was a repeating comment regarding the retrofit process and outcome. Also very strong outcome of retrofit value in relation to rent level. The reduced cost for heating was often referred to when motivating the value of retrofit, but also architectural improvements.
Aspect	Identified conflicts
Well-being and health	No significant conflicts could be perceived from the graph but some negative comments regarding the light situation, <i>“basement too dark”</i> , <i>“dark on the north side”</i> and <i>“kitchen darker due to new elevator”</i> .
Experience of the built environment	Some negative comments regarding people not caring about messing up the external corridor and also that new people have moved in: <i>“There are new people living in the house and in the surrounding I hardly know”</i>
Architectural qualities	Some negative remarks in the written comments regarding bad shape of external corridor and one negative comment regarding wooden flooring being damaged.
Information, communication and value of retrofit	The retrofit was probably the most difficult given its wide scope and impact as the tenants stayed in their dwellings during retrofit. Some problems with work in apartment, as indicated in the graph but also from the comments by the tenants. The comments mostly regarded miscommunication with craftsmen. <i>“Chaotic situation. Craftsmen have disrespected personal belongings”</i>

Figure 17: Summary evaluation – Augsburg.

3.4.2 Evaluation of Halmstad, Sweden

Well-being and health:

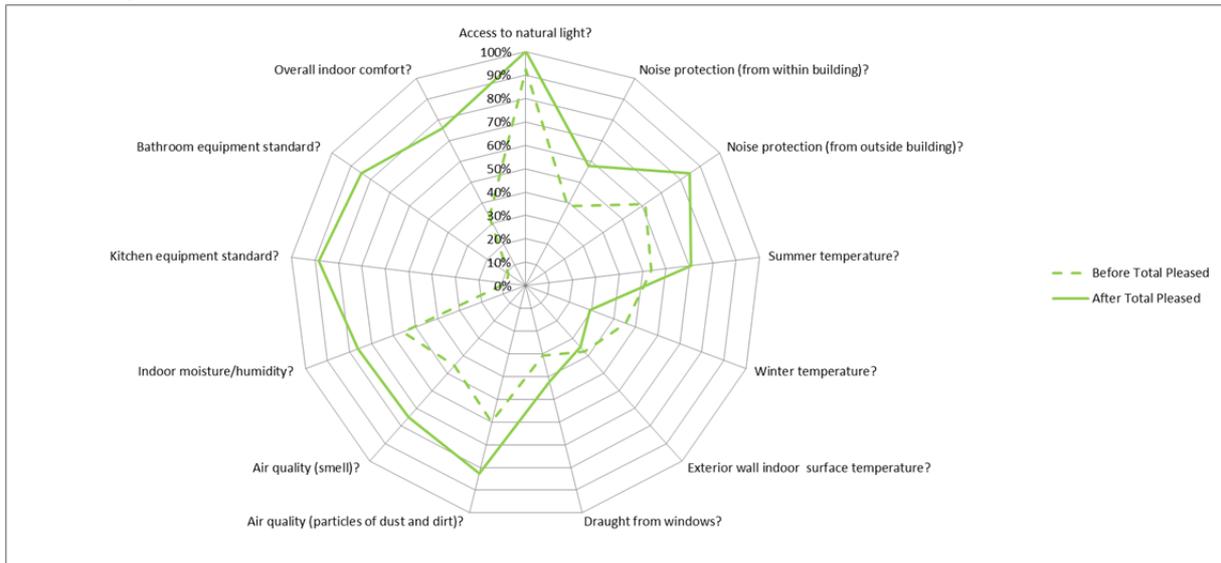


Figure 18: Evaluation of *Well-being and health* before and after retrofit, Halmstad.

Experience of the built environment:

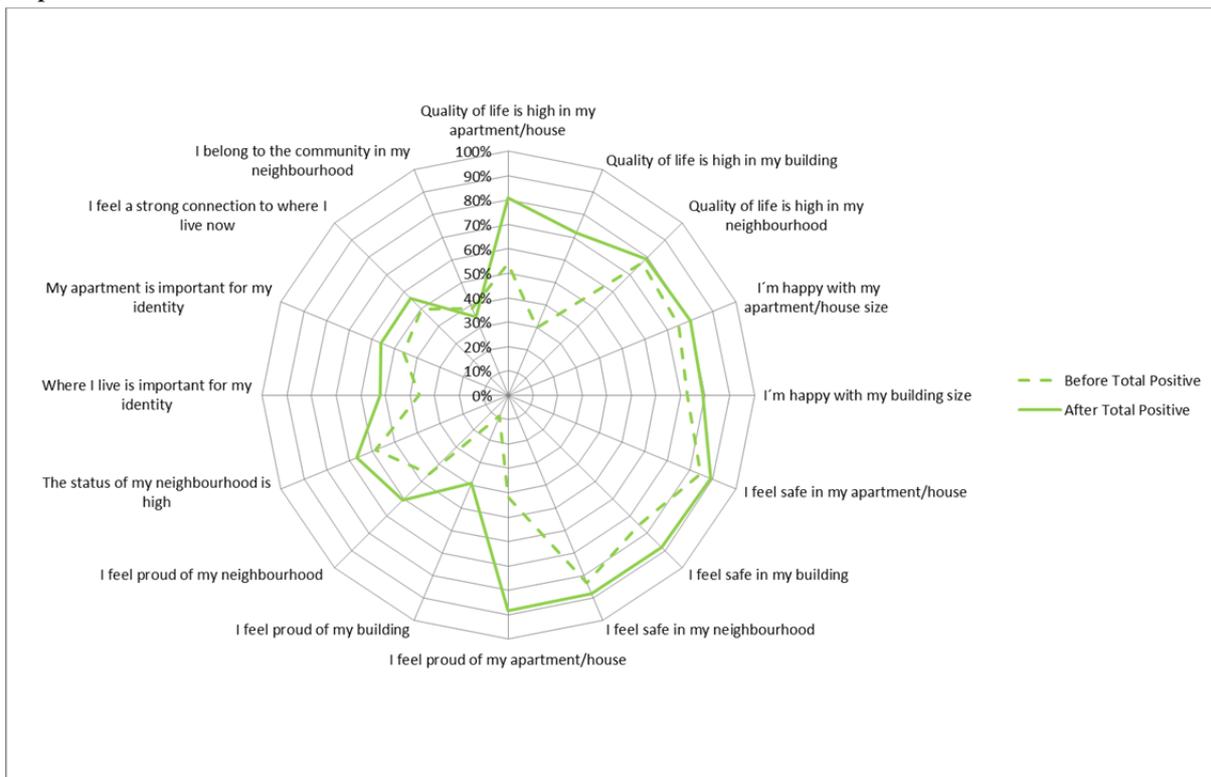


Figure 19: Evaluation of *Experience of the built environment* before and after retrofit, Halmstad.

Architectural quality:

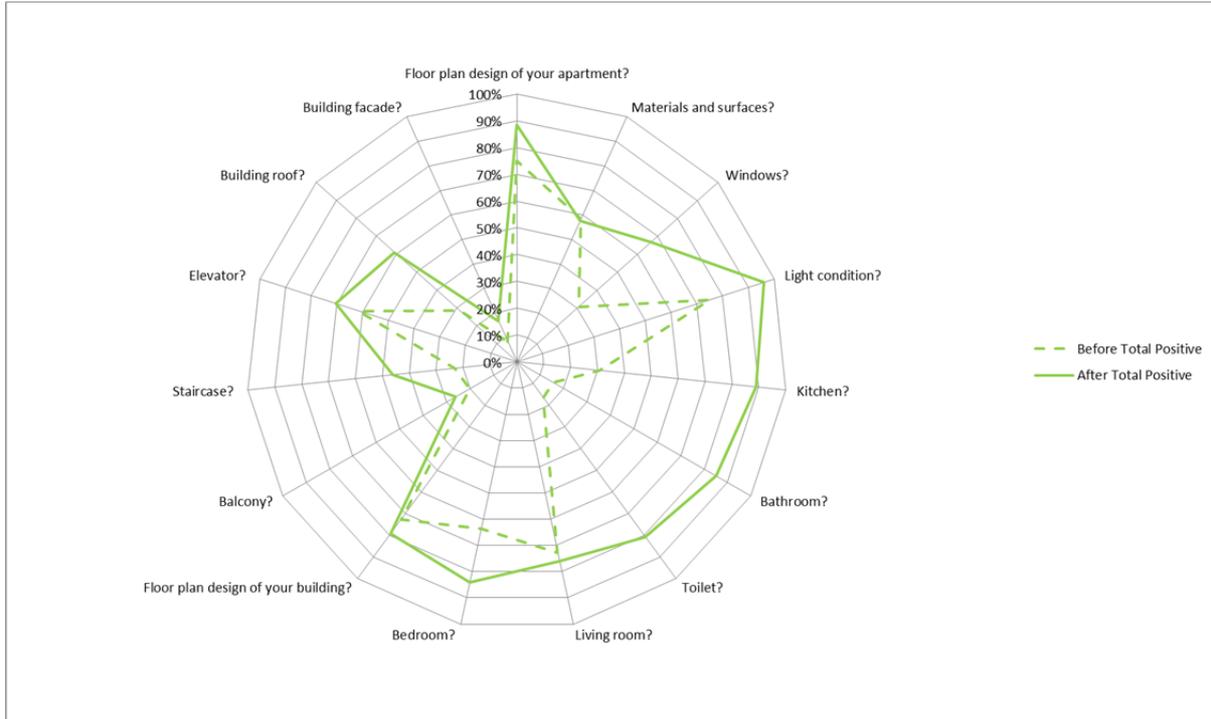


Figure 20: Evaluation of *Architectural quality* before and after retrofit, Halmstad.

Information, communication and value of retrofit:

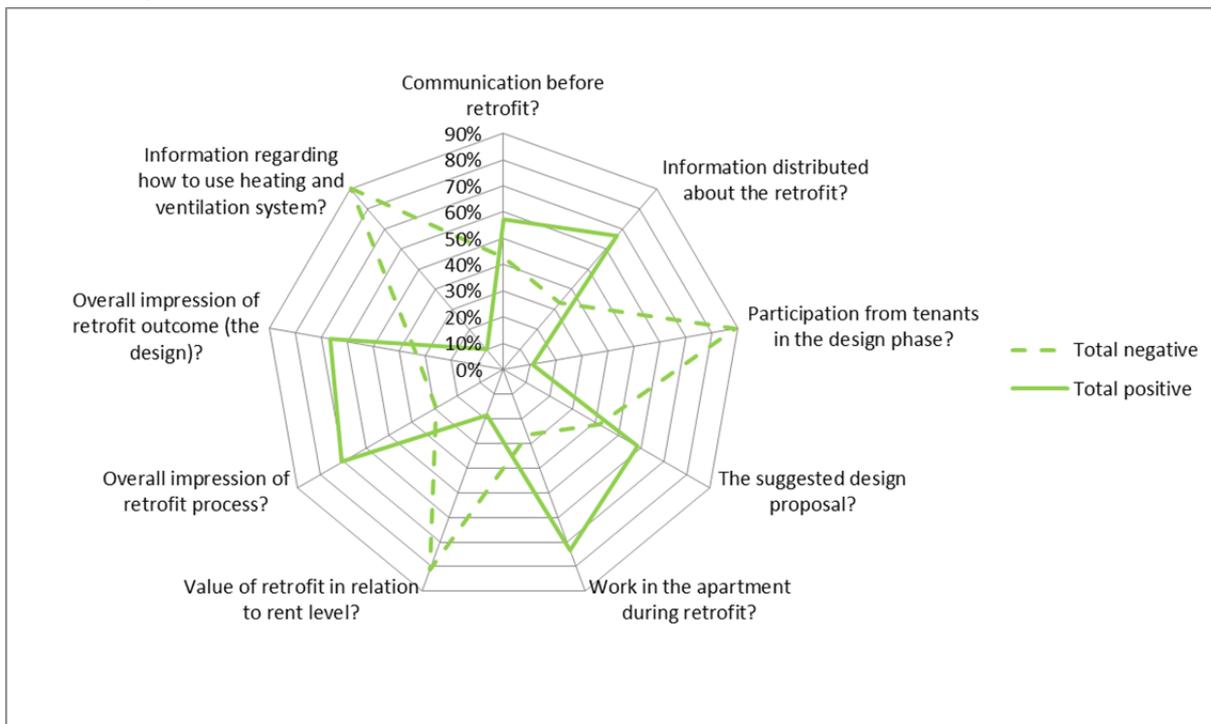


Figure 21: Evaluation of *Information, communication and value of retrofit*, Halmstad.

Summary of evaluation – Halmstad	
Aspect	Positive social impacts
Well-being and health	<p>Strong increase in perceived kitchen and bathroom equipment standard. Also strong increase in air quality. The retrofit had a strong focus on increasing the interior standard, which the graph clearly illustrates, as well as the comments from the tenants:</p> <p><i>“The previous apartment was very worn down, especially the kitchen and bathroom. This one is nice and light.”</i></p> <p><i>“Better living standard in the apartment.”</i></p>
Experience of the built environment	<p>Strong increase in proudness of both apartment and building and the perceived quality of life in building but in particular in apartment.</p> <p><i>“Im happy with my life, due to a large part that im happy with my living situation in my apartment.”</i></p>
Architectural qualities	<p>Overall a strong increase in perceived architectural qualities, especially the aspects of kitchen, bathroom and windows.</p>
Information, communication and value of retrofit	<p>Varied reactions to aspects regarding information and communication. Positive reaction towards work in apartment and the final retrofit design.</p> <p><i>“It was done well and correct. I liked the easter greeting on the kitchen bench.”</i></p>
Aspect	Identified conflicts
Well-being and health	<p>Many remarks regarding cold winter temperature, which is also clear in the graph.</p> <p><i>“Winter time our quality of life is negatively affected by the cold temperatures inside.”</i></p> <p><i>“The apartment is nice. But draught and cold is a big problem, most of the cold is coming from window and ventilation.”</i></p>
Experience of the built environment	<p>Slightly less positive response to “I belong to the community in my neighbourhood” after retrofit. Some comments regarding tenants moving away before retrofit and the situation within the aspect of <i>Information, communication and value of retrofit</i> might explain this decline.</p>
Architectural qualities	<p>No conflicts could be identified.</p>
Information, communication and value of retrofit	<p>The graph and comments from tenants show a lack of information regarding ventilation and heating. However, this reaction had probably a strong connection to the fact that some tenants are dissatisfied with the lack of control over ventilation and cold winter temperatures, rather than a lack of information. Also negative responses towards value of retrofit in relation to rent level.</p>

Figure 22: Summary evaluation – Halmstad.

3.4.3 Evaluation of Munich, Germany

The Munich demo was evaluated only after renovation given that the demo was evicted prior to the renovation. Therefore the aspect of *information, communication and value of renovation* was not possible to evaluate.

Well-being and health:

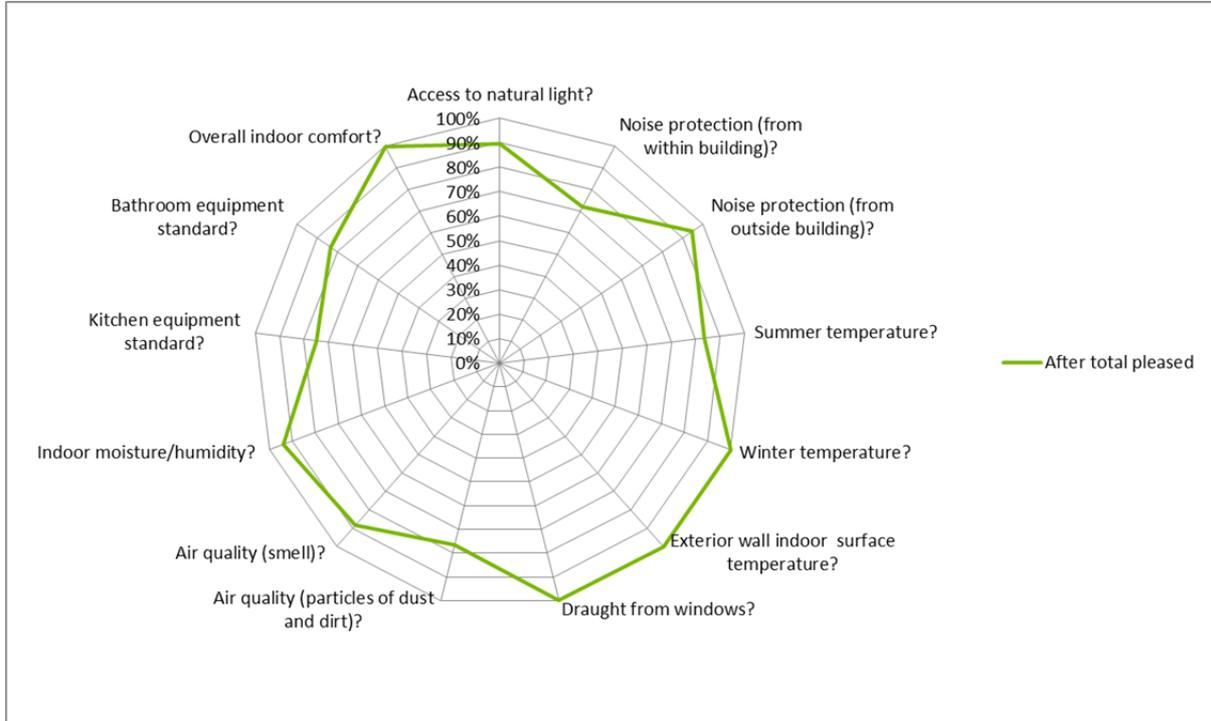


Figure 23: Evaluation of *Well-being and health* before and after retrofit, Munich.

Experience of the built environment:

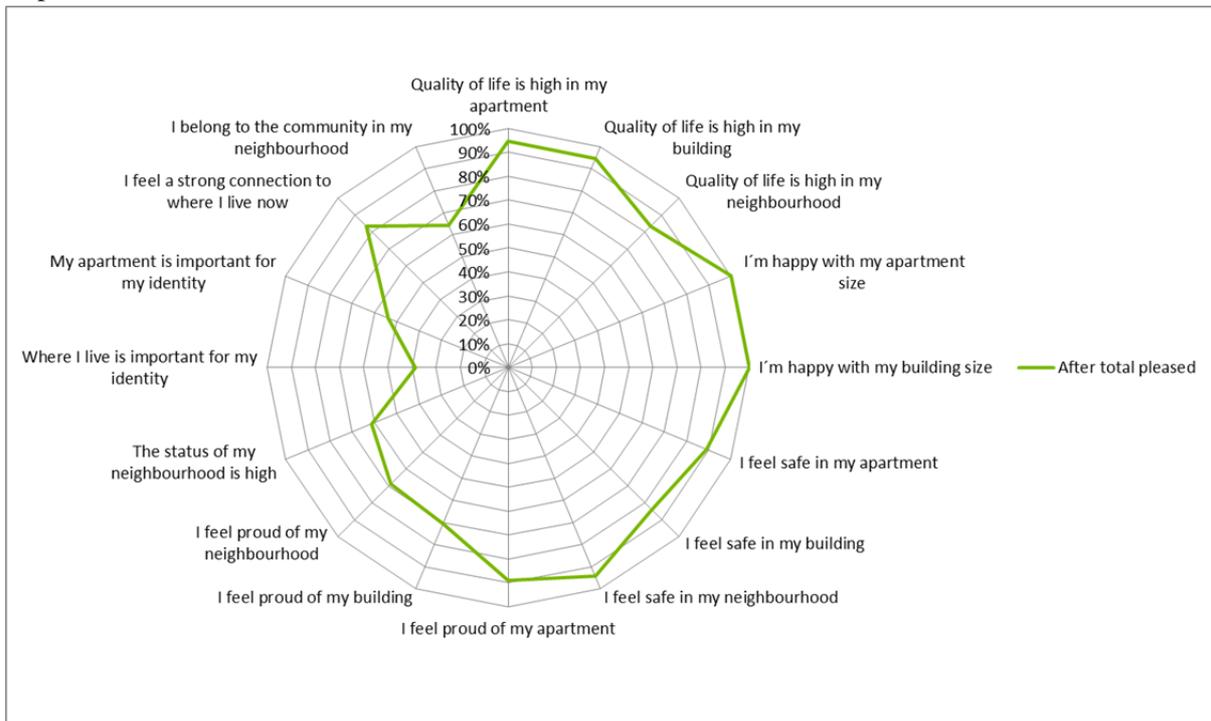


Figure 24: Evaluation of *Experience of the built environment* before and after retrofit, Munich.

Architectural quality:

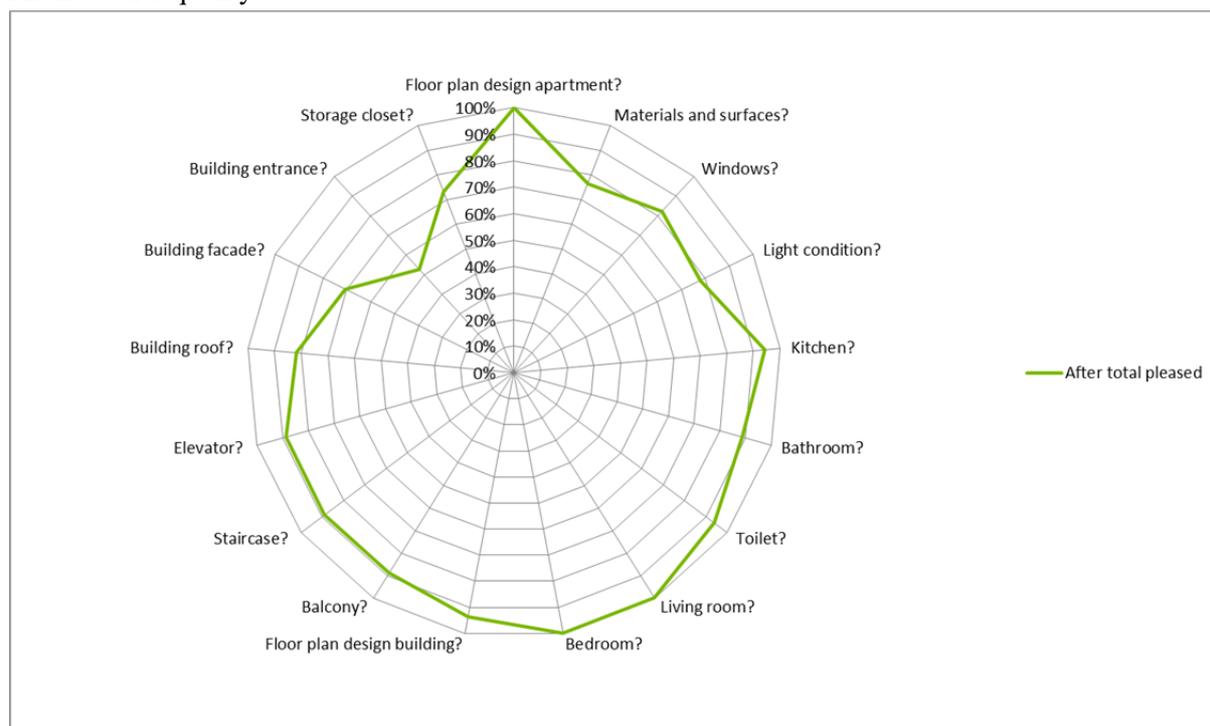


Figure 25: Evaluation of Architectural quality before and after retrofit, Munich.

As there is no before and after comparison possible to be drawn from the data covering the data from Munich the summary will focus on highlighting indicators with high tenant scores with reference to comments from tenants.

Summary of evaluation – Munich	
Aspect	Positive social impacts
Well-being and health	The retrofit in Munich was extensive in terms of its physical impact on the building. The tenant reactions show that indicators such as winter temperature, draught from windows and air quality are strongly evaluated. Indicators which have proved hard to reach equally strong scores at some of the other demos “very comfortable living climate.”
Experience of the built environment	Some of the tenants have a long history with living in the neighbourhood, and also comments that the neighbourhood is safe and clean. Some tenants have moved to the building given the retrofit concept. “Very high quality of life in the apartment and house.” “Close to city center, southern districts, Westpark, nice context” “Very friendly and helpful neighbors and manager.”
Architectural qualities	In general high scores except building façade, building entrance and storage closet. “Very beautiful apartment and house.”
Information, communication and value of retrofit	All dwellings was evicted prior to renovation, so new tenants moved in which had no experiences with the renovation.

Aspect	Identified conflicts
Well-being and health	<p>Some negative remarks regarding sound proofing and indoor heat in summer times which motivates the slightly lower scores on these indicators.</p> <p><i>“Indoor temperature in summer is too high for me (27°C/28°C – especially west side). From my point of view, missing shutters as well as no possibility to shut down ventilation (warm air is transported to the inside) are causing the problem.”</i></p> <p><i>“Sound proofing not satisfactory. “we can hear our neighbors above walking, sneezing, laughing...”</i></p>
Experience of the built environment	<p>Some comments regarding the entrance door which might motivate the slightly lower score on this indicator. Also rather low scores on <i>I belong to the community in my neighborhood</i> and <i>Where I live is important for my identity</i> which might be related to the fact that the building was evicted during renovation.</p> <p><i>“No house entrance door, therefor a feeling of being unsecure.”</i></p>
Architectural qualities	<p>Again some comments regarding the entrance door, which might motivate the low score on this indicator.</p>
Information, communication and value of retrofit	<p>All dwellings was evicted prior to renovation, so new tenants moved in which had no experiences with the renovation.</p>

Figure 26: Summary of evaluation – Munich.

3.4.4 Evaluation of Oulu, Finland

Well-being and health:

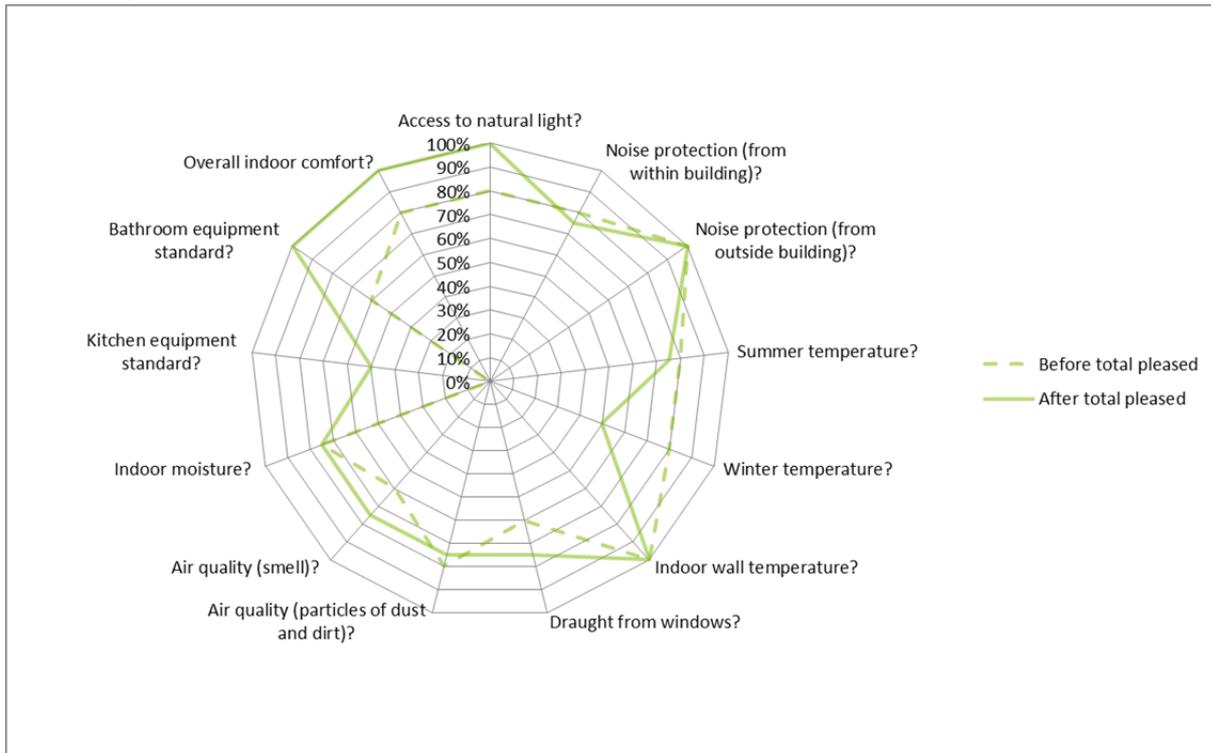


Figure 27: Evaluation of *Well-being and health* before and after retrofit, Oulu.

Experience of the built environment:

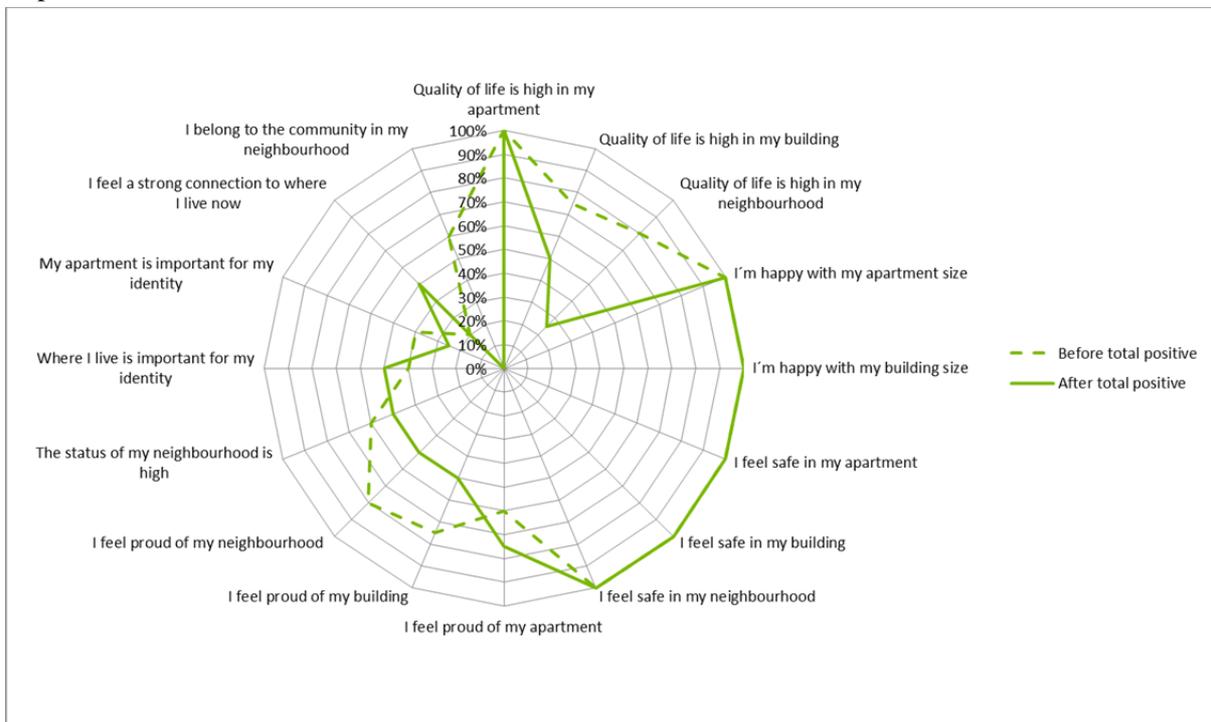


Figure 28: Evaluation of *Experience of the built environment* before and after retrofit, Oulu.

Architectural quality:

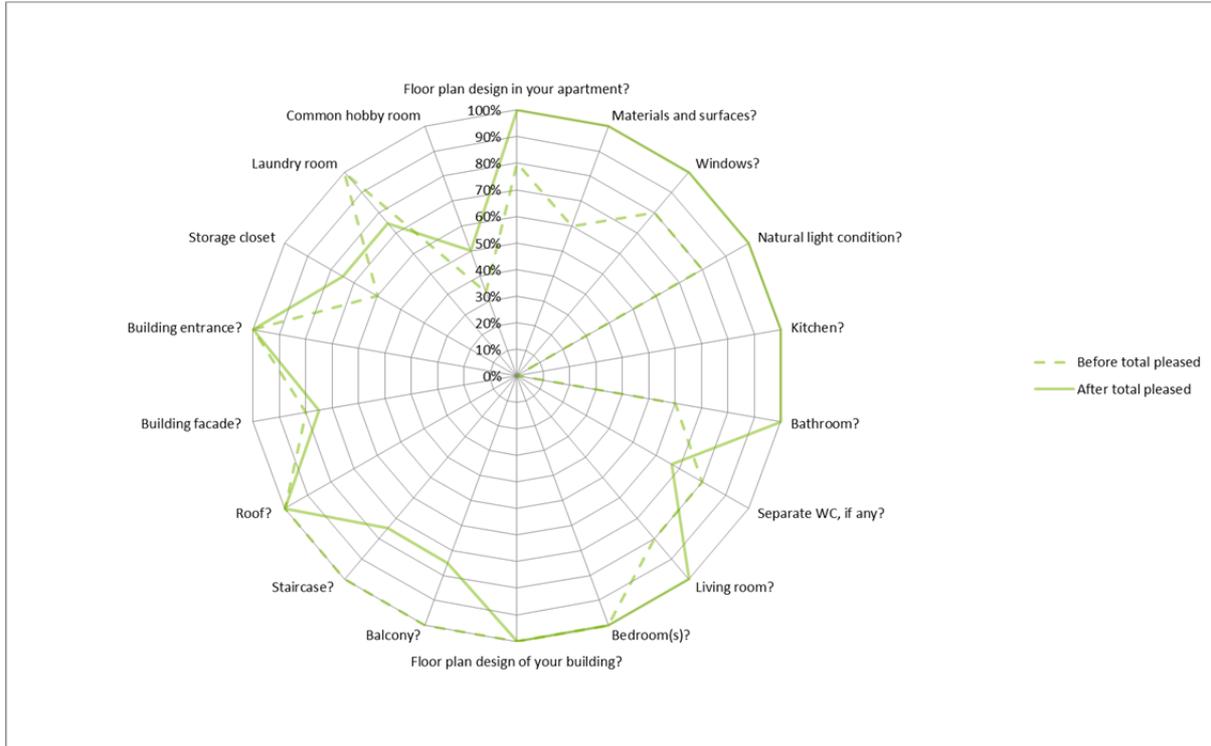


Figure 29: Evaluation of *Architectural quality* before and after retrofit, Oulu.

Information, communication and value of retrofit:

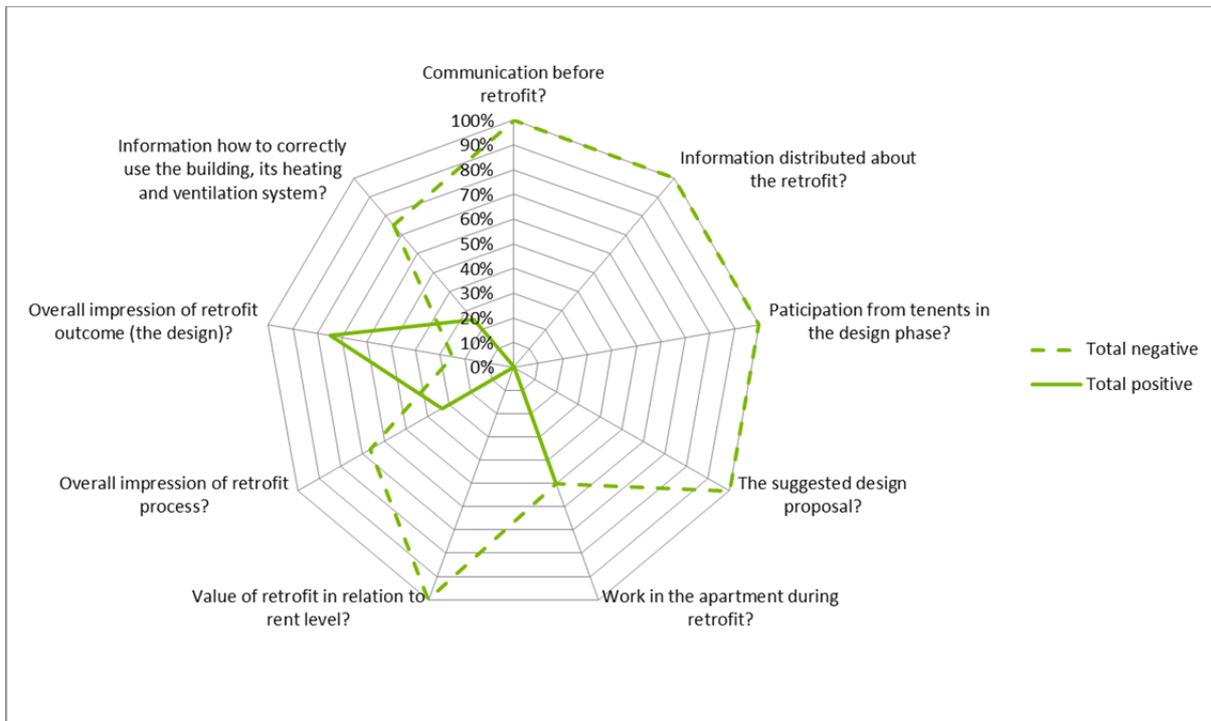


Figure 30: Evaluation of Information, communication and value of retrofit, Oulu.

Summary of evaluation – Oulu	
Aspect	Positive social impacts
Well-being and health	Strong increase in kitchen and bathroom standard as well as access to natural light.
Experience of the built environment	Some increase in proudness of apartment. A continuous strong evaluation of feeling safe in apartment, house and neighbourhood. <i>"New surfaces and a fine apartment raise the quality of life and comfort."</i> <i>"The new surfaces are attractive and are easy to keep clean."</i> <i>"it was really nice the first 3 months, before the other houses around the yard began to be the renovated"</i>
Architectural qualities	Overall a strong increase in perceived architectural qualities regarding public spaces within the building but also balcony design and bathroom. <i>"We got a finer and lighter apartment compared to our previous apartment."</i> <i>"the newly refurbished building looked smart and comfortable"</i>
Information, communication and value of retrofit	Positive response to the retrofit design and its outcome, but otherwise the evaluation show negative responses.

Aspect	Identified conflicts
Well-being and health	Apartments on the lowest level (4 apartments) had some problems with mould caused by the renovation. These apartments had to be evicted and repaired between December 2013 and March 2014. The tenants interviewed all lived on the second level but the comments regarding well-being and health show they too were effected. Also some comments regarding summer and winter temperature. <i>"The rating for smell is downgraded due to the [downstairs] fungus problem in autumn 2013 [actinomycetes building mould], which we could clearly smell in our second-floor hallway. It helped to tape close the door threshold with duct tape and we did not use the cooker hood. After the repairs [in December 2013] the smell does not seem to be noticeable in the apartment. Entrance hall still occasionally smells of the fungus [mould]."</i> <i>"In summer the apartment was even surprisingly cool in the hottest weather, but in very cold winter weather the apartment was sometimes a little too cold."</i>
Experience of the built environment	The low scores on some of these indicators show the effect of tenants moving into a neighbourhood still under retrofit, and also having to handle some initial repairs in the occupied building. <i>"The apartment and the area where one lives have a major impact on the quality of life. The view from the windows also affects it. Now, on our balcony side we see a construction site, and on the bedroom side we see forest. Also the cleanliness of the surrounding affects one."</i>

Architectural qualities	The tenants were preoccupied with the disturbances that they suffered from ongoing repairs and renovations, but despite this there were some consistent positive comments from all interviewed tenants about the refurbishment:
Information, communication and value of retrofit	<p>Not proper information and communication regarding the renovation scheme in the area and the repairs being done in the building caused low score within this aspect and probably also lead to low scores within the aspect of <i>Experience of the built environment</i>.</p> <p><i>“We never received information from PSOAS by email or post about why all the neighbours began to move out, or why the downstairs apartments began to renovated again. We only heard about the reasons for the smell problems after enquiring about the matter from a neighbor.”</i></p> <p><i>“This apartment has been the most stressful of the apartments where I have ever lived in my life (and there have been close to ten). The renovations in the surrounding have brought a lot of grief and stress, and we had to figure things out by ourselves, even though it would have been easier for all if PSOAS had handled the appropriate communication on time.”</i></p>

Figure 31: Summary of evaluation – Oulu.

3.4.5 Evaluation of Roosendaal, Netherlands

Well-being and health:

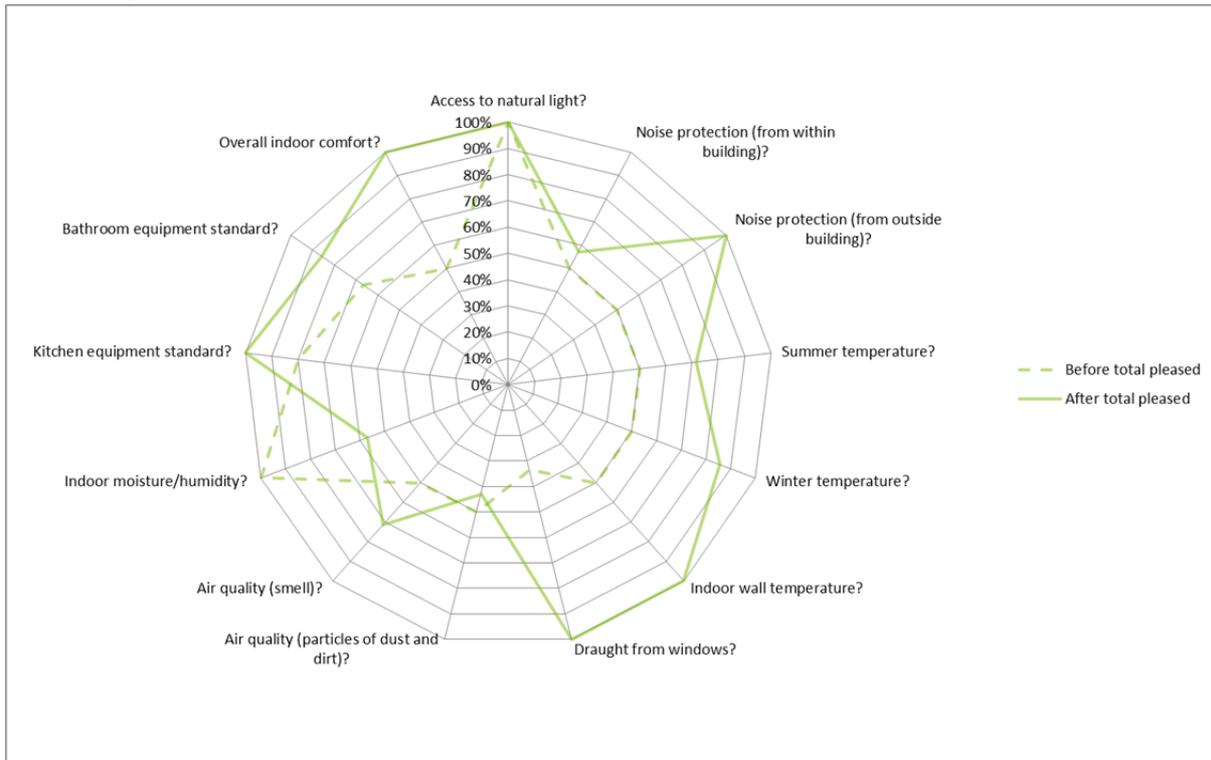


Figure 32: Evaluation of *Well-being and health* before and after retrofit, Roosendaal.

Experience of the built environment:

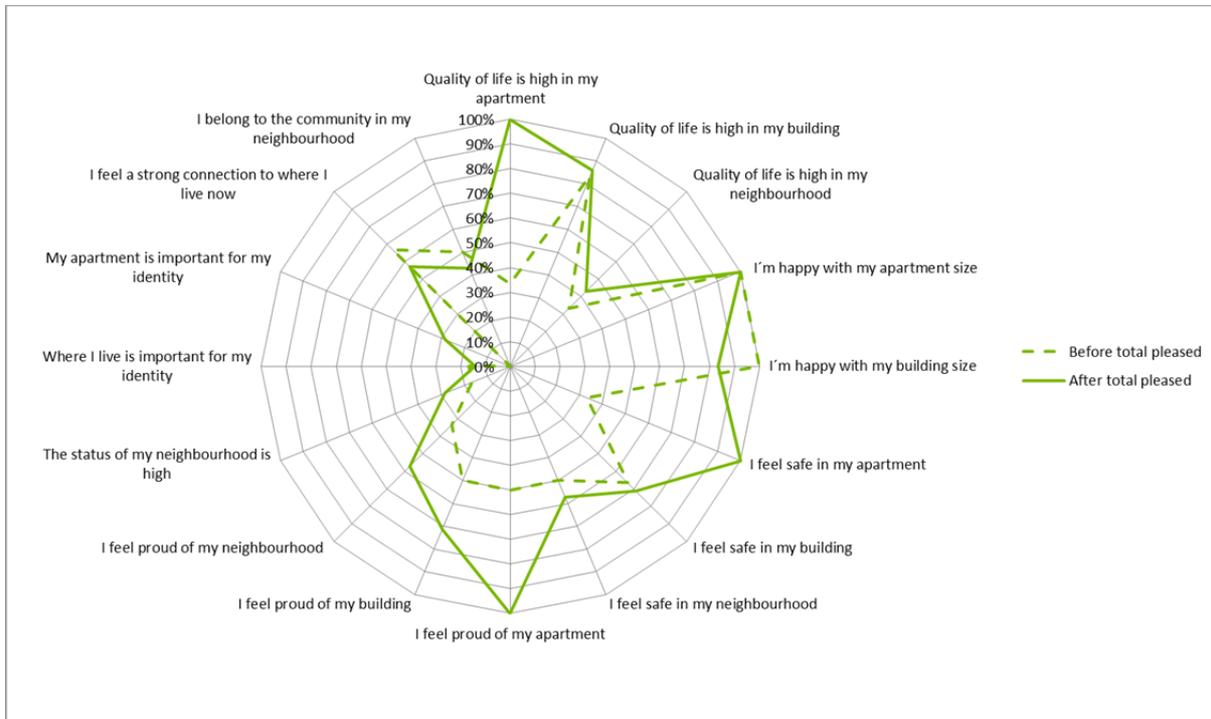


Figure 33: Evaluation of *Experience of the built environment* before and after retrofit, Roosendaal.

Architectural quality:

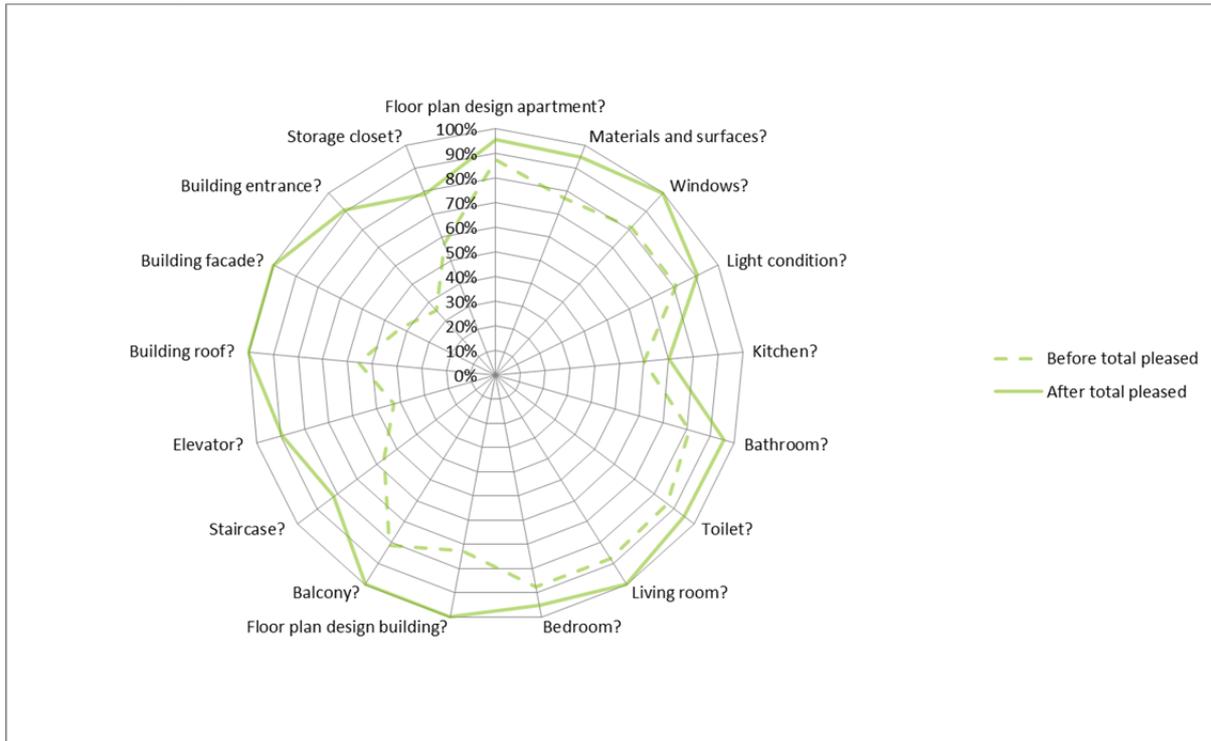


Figure 34: Evaluation of *Architectural quality* before and after retrofit, Roosendaal.

Information, communication and value of retrofit:

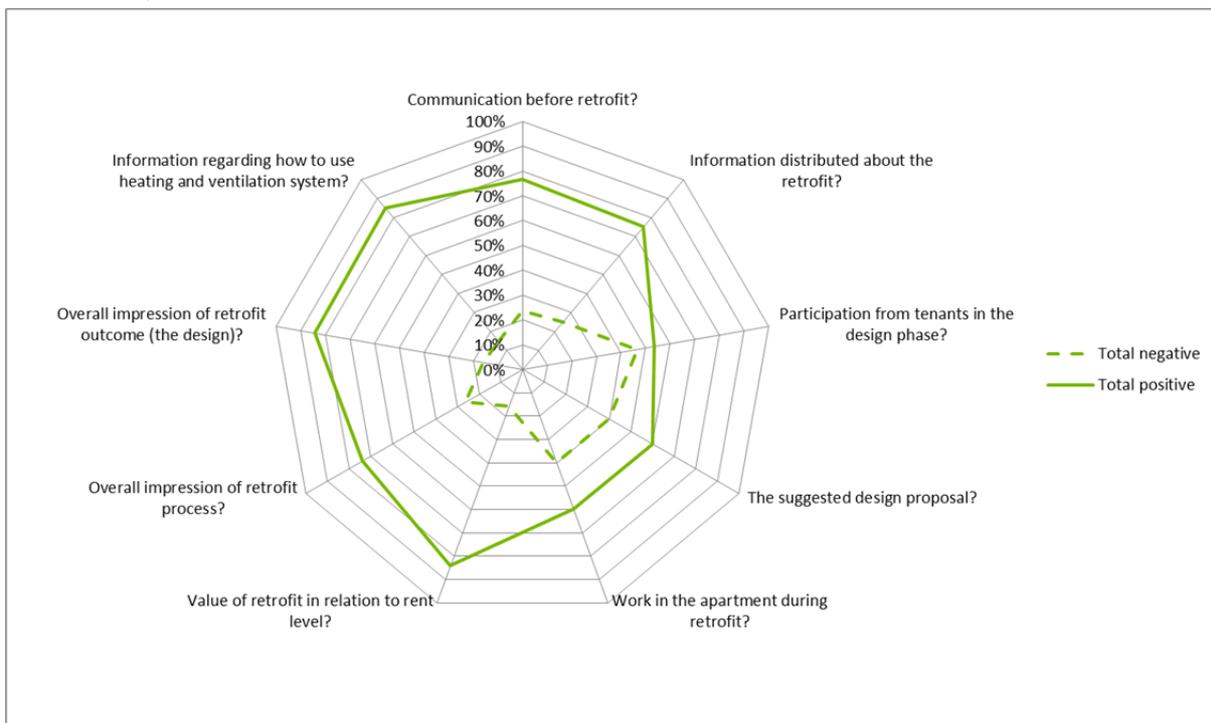


Figure 35: Evaluation of Information, communication and value of retrofit, Roosendaal.

Summary of evaluation – Roosendaal	
Aspect	Positive social impacts
Well-being and health	Strong increase in indoor comfort, especially regarding temperatures and draught. <i>“No more draughts and better insulation”</i>
Experience of the built environment	Many positive comments regarding improved appearance of both the house and public spaces in the area, which explains positive post-retrofit reactions towards proudness and quality of life, especially on the building and apartment level. Also a strong increase in feeling of safety in apartment. <i>“Due to the renovation, more proud of the house and I feel more enjoyable because of that”</i>
Architectural qualities	Strong increase in external indicators within architectural qualities, harmonising with the focus of generating improved appearance of the buildings and public spaces in the area. <i>“More modern design and design garden in front of the house”</i>
Information, communication and value of retrofit	Overall positive reactions within this aspect. Information and communication with tenants had a strong emphasis before and during retrofit at the demo, which has been perceived well from tenants responding to the questionnaire. Even positive reactions towards work in apartment, which was rare reaction in the collected data from all demos. <i>“Had a lovely time, sociable with the workmen”</i>
Aspect	Identified conflicts
Well-being and health	Decreased evaluation of indicators <i>Indoor moisture/humidity</i> and <i>Air quality (particles of dust and dirt)</i> . No explanation from tenants motivates this development.
Experience of the built environment	Values connected to the area; identification, proudness, perceived status, are low. The neighbourhood, in comparison to other E2ReBuild demos, is characterised by less spatial connections to surrounding areas and also a somewhat more varied tenant structure in terms of ethnical origin. Hopefully the focus on increased qualities in public spaces in the area and that quality of life and proudness on the apartment scale has increased due to the retrofit, will generate positive changes the coming years.
Architectural qualities	No identified conflicts.
Information, communication and value of retrofit	No negative comments within this aspect. The retrofit has some initial problems regarding tenant reactions but given a strong emphasis on developing personal communication and strong information channels seems to have given a positive effect.

Figure 36: Summary of evaluation – Roosendaal.

3.4.6 Evaluation of Voiron, France

Well-being and health:

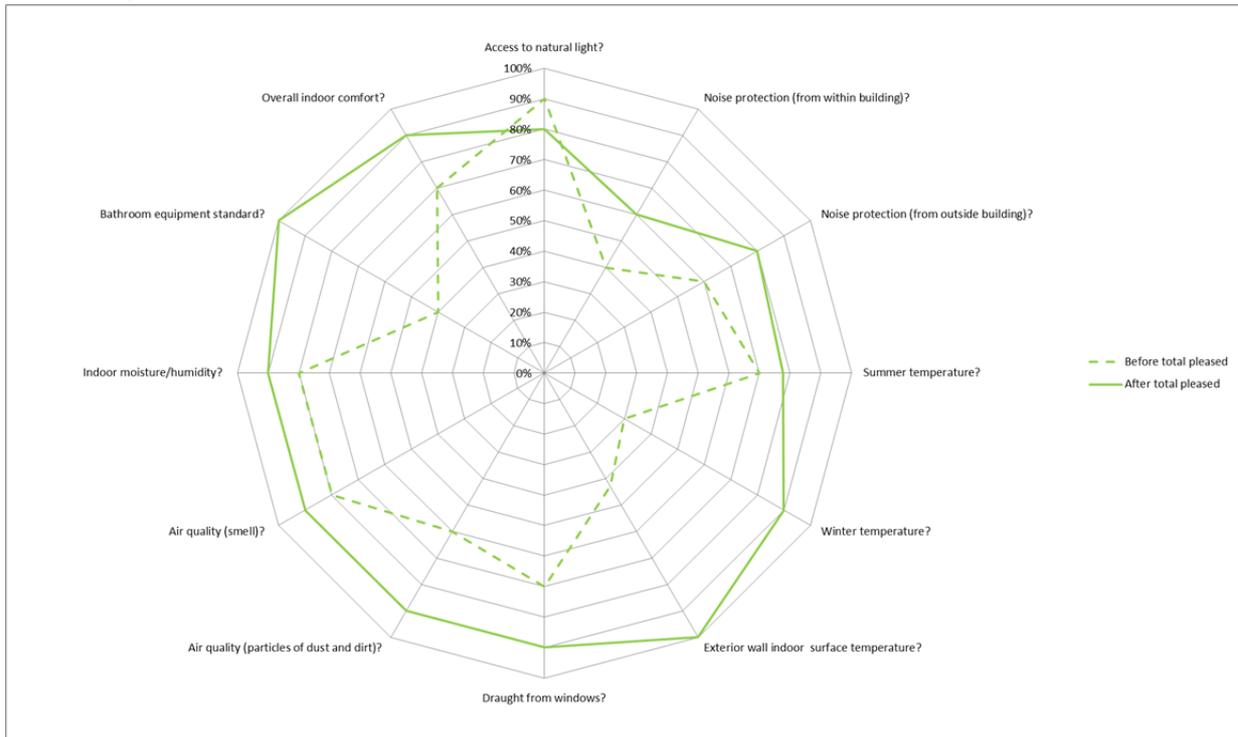


Figure 37: Evaluation of *Well-being and health* before and after retrofit, Voiron.

Experience of the built environment:

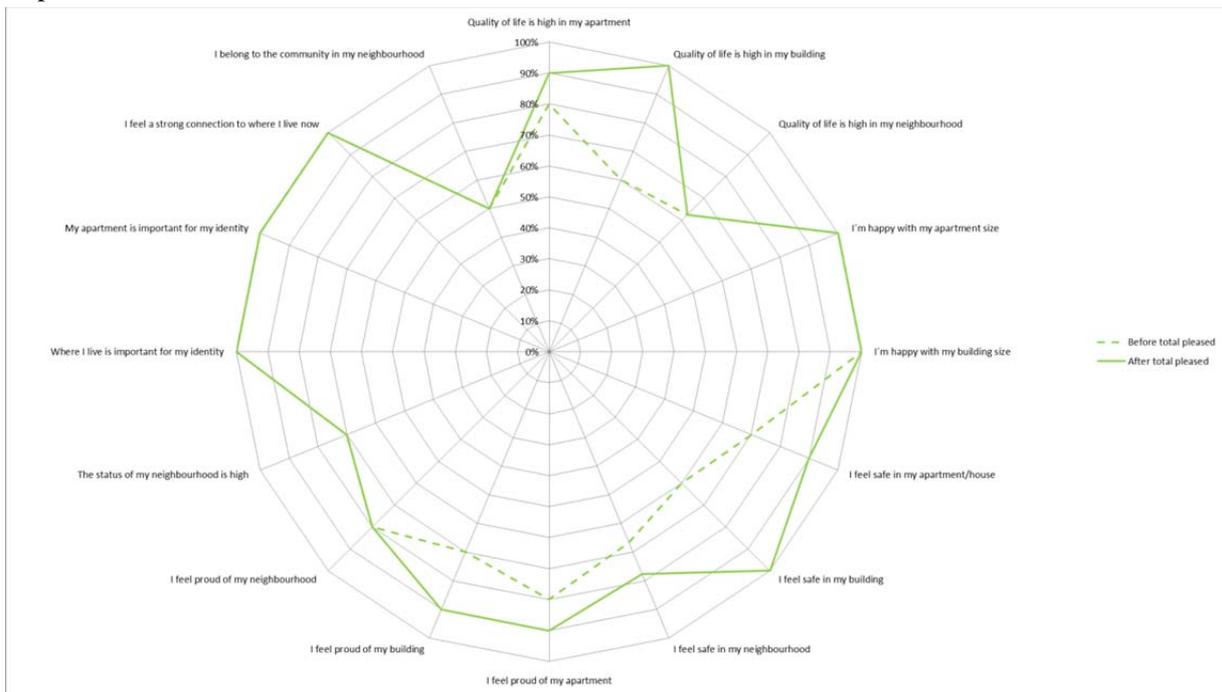


Figure 38: Evaluation of *Experience of the built environment* before and after retrofit, Voiron.

Architectural quality:

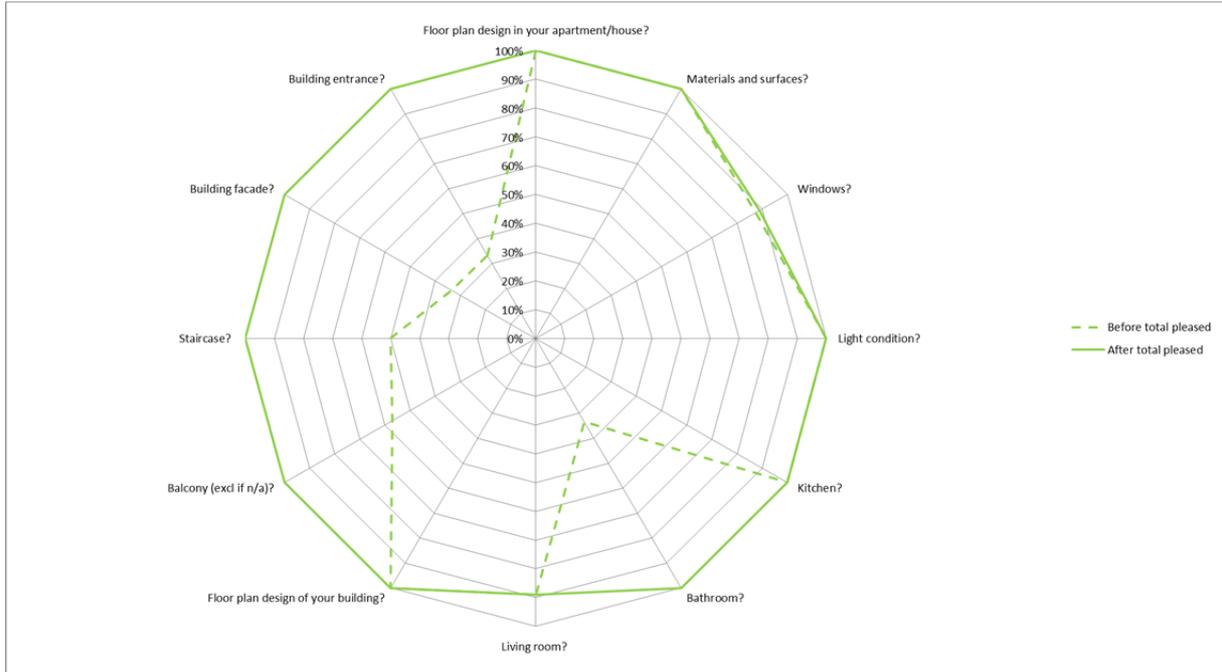


Figure 39: Evaluation of *Architectural quality* before and after retrofit, Voiron.

Information, communication and value of retrofit:

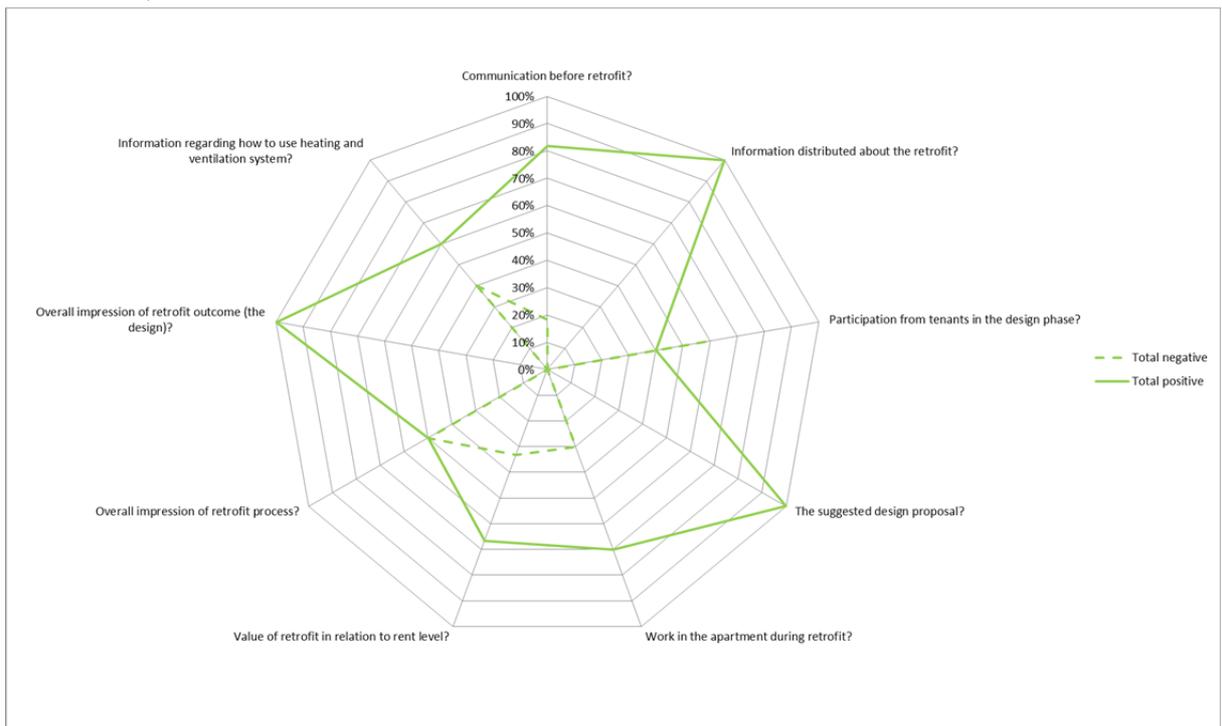


Figure 40: Evaluation of Information, communication and value of retrofit, Voiron.

Summary of evaluation – Voiron	
Aspect	Positive social impacts
Well-being and health	Overall an increase in measured well-being and health, except regarding <i>access to natural light</i> . <i>Winter temperature, bathroom equipment standard and air quality</i> had the strongest increase. <i>“The closing of the balcony reduces light but has improved the thermal comfort.”</i> <i>“Happy with the collective heating (compare to its previous electric heaters)”</i>
Experience of the built environment	<i>Quality of life, proudness and safeness</i> regarding the building has increased substantially, to a lesser extent measured through the apartment scale and no change on the neighbourhood scale except from a slight increase of safeness. <i>“looks renewed and cleaner.”</i>
Architectural qualities	Overall a strong increase in perceived architectural qualities regarding public spaces within the building but also balcony design and bathroom. <i>“Very satisfied, the buildings look very good.”</i>
Information, communication and value of retrofit	Strong positive response regarding the retrofit design, its outcome and information distributed about the retrofit. <i>“Very satisfied about the project Already aware on many ways to reduce my consumption.”</i> <i>“too long but good contacts with the workers”</i>
Aspect	Identified conflicts
Well-being and health	Decreased post-evaluation within the indicator <i>Access to natural light</i> . Comments from tenants indicate that the closing of the balconies might explain this development.
Experience of the built environment	No identified conflicts.
Architectural qualities	Some negative comments regarding closing of balcony reducing access to natural light.
Information, communication and value of retrofit	Some negative comments regarding work in apartment; that it took too long. <i>“Work was too long.”</i>

Figure 41: Summary of evaluation – Voiron.

4 Social Impacts and Added Values – Multi Stakeholder Value Chains

4.1 Well-being and Health

4.1.1 Indoor Comfort - Socio-ecological Value Generation

Indoor comfort, evaluated from the perspective of winter and summer temperature, generated several comments from tenants, and also great variances when comparing the results between the demos. Also the aspect of noise protection was a factor with quite a lot of variation.

The correlation between reduced energy consumption and increased indoor comfort was an added value found in Halmstad where the perceived noise from outside the building was reduced given the installation of new windows with better sound and thermal insulation, which further improved the energy performance of the building.

In Augsburg a correlation between increased appreciation/evaluation of summer and winter temperature through the installation of winter gardens, also increased the thermal comfort and reduced energy consumption.

These examples show the potential of generating added values through retrofit aspects which targets aesthetic, social and environmental value increases and also generating long term economic incentives by reducing the cost of heating.



Figure 42: Winter garden, Augsburg
(Source: Frank Latke)



Figure 43: New windows, Halmstad
(Source: Stephen Burke)

Previous research on end-user behaviour in low-energy consuming houses shows that ventilation and heating are both difficult to manage from an end-user perspective and has led to problems with air flows and indoor temperature.¹³ This is an important aspect to highlight also in relation to experiences drawn from some of the E2ReBuild demos. Following the results from the tenant questionnaire, the Halmstad and Oulu demo show decreased values within the aspect of “winter temperature”. Tenants, in the questionnaires, express complaints about low winter temperatures and in Halmstad also draught from windows and ventilation. In Halmstad some tenants have adopted innovative solutions to tackle the problem of draught and cold indoor temperature by simple shutting the air inflow through applying duct tape over it. These strategies might cause a short term increase of indoor thermal comfort but might at the same time decrease air quality and generate moisture problems in the longer perspective.

¹³ Zalejska-Jonsson (2011) *Low-energy residential buildings, evaluation from investor and tenant perspectives*

4.2 Experience of the Built Environment and Architectural Qualities

4.2.1 Quality of Life

Several of the E2ReBuild demos show an increase in the aspect of quality of life, judged from the evaluation of their tenants. How tenants motivate this increase varies greatly, which underlines the social and potentially also cultural differences in how tenants value their living situation. Tenants in Halmstad and Oulu, for example, express how the increased kitchen and bathroom standard generates a feeling of living in a newly renovated apartment in which new equipment and surfaces spread a nice and modern ambience. Tenants in Voiron and Augsburg express a high appreciation of the new façade and relate this increase to increased pride in the building and to quality of life. One potential interpretation of these findings is that Swedish and Finnish tenants in general correlate indoor changes to the aspect of quality of life to a greater extent than French and German tenants. From a Swedish perspective the focus on increasing the standard of the apartment, through installing new kitchen facilities and changing surfaces in kitchen and bathroom, generates legal incentives for rent increases.

Other measures that from the tenants perspective were related to an increased quality of life were decreased noise from outside the building in Voiron, Halmstad, Roosendaal and Augsburg. This is a strong added value given the measures generating this social impact target reduced energy consumption through better insulation.

4.2.2 Identification, Pride and Security

The indicator of security was measured on the apartment, building and area scale. The aspect of security was increased at most of the demos. The installation of new entrance locking systems in Halmstad, Voiron and Augsburg generated an increased sense of security at the building level. In Roosendaal the security on the neighbourhood scale and within the apartment was increased given an emphasis on regenerating public spaces in the area. The aspect of security should not be neglected as an aspect with the potential of generating added value for other stakeholders. An increased sense of security will for example create stronger incentives for especially older and female tenants to feel comfortable and move freely at dark hours which generate more movement in the area and acts as an added value for generating a secure feeling also for other tenants. The lack of security also limits the sense of community.

4.3 Information, Communication and Value of Retrofit

4.3.1 Information and Communication as Key Aspects for a Positive Outcome

The aspect of information and communication has been highlighted before as key factors for the success of a retrofit; from a tenant perspective but also in relation to other stakeholders. Deliverable 3.1, “*Evaluation of collaboration models*”, highlights the need for strong collaboration between professional stakeholders; to establish trust between partners, to set shared goals and to facilitate efficient production design as well as production on site. Further, the deliverable stresses the need for creating strong communication channels towards tenants, to limit distress and build trust and user-acceptance.

Studying experiences and reactions from tenants throughout the E2ReBuild demos further stresses the need for strong communication channels between tenants and stakeholders involved in the retrofit and especially the owner. The problems with cold winter temperatures experienced by tenants in Halmstad and Oulu described under 4.1.1, indicates a lack of understanding of the buildings systems and how to operate it properly. The lack of information and understanding leads to distress and in the aspiration of taking control, tenants adopt their own solutions, like simply adding a layer of duct tape to block the air inlets, like some tenants did in Halmstad.

In Oulu tenants experienced distress due to some initial problems with mould in the lower apartments and further living next to later renovations of surrounding building. Tenants did not feel properly informed, which to a large extent explains low figures on the evaluated social impact aspects. Given the installation of new technology to control and monitor ventilation and heating in the Oulu demo NCC Finland arranged a training session at the demo site which tenants were invited to. Some tenants missed to attend this event and given it were only arranged once the tenants who missed it expressed complaints in the tenant questionnaire.

Figure 44 illustrates how and through which means tenants were involved throughout the retrofit at the different demos. Following the tenant’s reactions from Halmstad and Oulu it is a lesson learnt not to forget information and communication after the Retrofit is finished. This is the stage during which tenants form new habits and adapts to a new living situation. To properly explain new systems for ventilation and heating does not only let tenants take control but further comprises an opportunity to reduce energy consumption through affecting the behaviour. Tenant behaviour and an increase in technology within the apartment/building is an aspect which should be given increased attention, to decrease tenant stress and lack of control and to use the opportunity to adjust both technology and tenant behaviour to generate potential energy savings. NCCs training session (living school), the handbook/DVD distributed in Roosendaal and the follow-up meeting arranged in Voiron acts as good examples for post-retrofit information distributed to tenants.

Overview - tenant collaboration and communication strategies			
	Before retrofit	During retrofit	After retrofit
Augsburg	Information meeting and through sent post.	Claim management handled by owner representative on site continuously during retrofit.	
Halmstad	Information meeting, distribution of information through post, mock up apartment.	Claim management handled through contractor NCC.	
Munich	Old tenants moved out prior to retrofit.	The building was vacant during retrofit but communication with future tenants regarding equipment choices.	
Oulu	Old tenants moved out prior to retrofit.	The building was vacant during retrofit.	Information meeting regarding functionality and operation of new systems.
Roosendaal	Individual meetings with tenants and information meeting targeting all tenants, sent out information.	Claim management handled by the tenants association.	Tenant handbook and DVD covering operation of new systems and general information regarding new housing situation.

Voiron	Questionnaire to all tenants, information meeting, distribution of information through post, mock up apartment.	Weekly tenant meetings.	Evaluation and follow up meeting one year after finished retrofit where a broad range of stakeholders takes part, including tenants.
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Figure 44: Overview tenant collaboration and communication strategies.

5 Design and Collaboration Strategies for Added Value Generation

5.1 Quality of Life as a Design Component

The aspect of quality of life is impossible to narrow down to a few physical aspects generating social values. The fieldwork conducted in Halmstad and Voiron and the results from the tenant questionnaire stresses the great variation in how tenants defines and links quality of life to their living environment and the changes to this that a retrofit causes. Aspiring an increased quality of life through a retrofit implies understanding the needs and situation of the tenants which homes are going to be retrofitted. The active participation of tenants is not the key aspect but integrating their needs as an aspect in the design process. If this is done by in house knowledge or by more inclusive measures might vary and should not be given a normative evaluation.

The evaluation of the demos shows that retrofit measures can generate positive social and ecological impacts without risking long time economic profitability.

5.2 Social Capital as a Process Outcome

Many demos saw an increase in proudness and security given physical changes of the building (Voiron, Augsburg, Roosendaal), its interior (Halmstad) and the area (Roosendaal). Voiron further experienced how an inclusive retrofit process can generate a strengthened sense of community between tenants and further build trust between tenants and the owner. These aspects should be viewed as added values with the potential of generating social capital which in the long term can decrease turnover and generate user acceptance in future renovation work.

Social capital has gained in importance in relation to urban planning and construction in general but especially within the field of urban renewal. A commonly referred to definition is made by American sociologist Robert S Putnam: “*features of social organization, such as networks, norms and trust, that facilitate coordination and cooperation for mutual benefit*”.¹⁴

The added value of trust generated within a retrofit is equally hard to quantify in monetary terms or relate to ecological values. Experiences from tenants, collected through the fieldwork, indicates the increased adaptability to the distress of a retrofit through the trust built by the building owner through previous actions. This adaptability is the proof of trust built between building owner and tenant, in turn creating incentives for a smooth retrofit process, or to paraphrase Putnam: “*facilitate coordination and cooperation for mutual benefit*”.

5.3 Socio-architectural Method and Recommendation for an Added Value Driven Renovation Process

The socio-architectural method aims to describe the added value generated by adopting a multidisciplinary approach at an early stage of a retrofit process. The purpose is not to suggest an exact collaboration framework with a given structure of participating stakeholders or analytical steps. The core aspect is to describe an overall framework for generating added values, emphasizing documentation and implementation of the needs of the tenants.

The inspiration for the theoretical framing of the method comes from the concept of method triangulation, design iteration and abductive reasoning. These three concept, although not explicitly mentioned, have all been adopted at the E2ReBuild demonstration projects.

¹⁴ Putnam (1993) *Making democracy work*. Princeton University Press

Triangulation is at its core a systematic approach for generation a greater understanding of an object through the combination of different viewing angels.

“Triangulation has been generally considered a process of using multiple perceptions to clarify meaning by identifying different ways the phenomenon is being seen.”¹⁵

This description echoes core conclusions generated by other deliverables within E2ReBuild such as *Evaluation of collaboration models* (Deliverable 3.1), stressing the need for a strong collaboration and team work among stakeholders for setting shared goals and generating smooth processes, and *Guidelines to off-site production / On-site assembly and logistics* Deliverable 4.2/4.3, stressing the need for a thorough understanding of initial project conditions and enabling a strong shared vision and planning through strong collaboration; in turn creating incentives for generating added values from an industrialized planning process using prefabricated elements.

In essence a holistic approach should be interpreted as value triangulation where social, ecologic and economic value changes must be met in order for a successful renovation to be achieved. By adopting method triangulation, different methods are used to unveil a greater understanding of the same phenomenon, process or object.

Triangulation captures the need to view the building under retrofit as a catalyst to generate quality of life and reducing energy consumption while at the same time not generating economic deficits.

Building on the experiences gained through the field studies, the results from the questionnaires and the research activities among E2ReBuild partners and specialists it is clear that communication, information sharing and team work is the key aspect for generating added values covering social, monetary and ecological value increase.

During the fieldwork conducted in Halmstad the method of walk through analysis was tested. During this all involved stakeholders makes an individual analysis of the building and one of its apartments, followed by a common discussion regarding strengths, weaknesses and potential improvements. The core purpose is, as in triangulation, to expand the understanding of the building. This is a knowledge transfer at the micro level through which the potential for future added values are increased by expanding the understanding of the building under retrofit through the involved stakeholders and early on exposing potential conflicts.

Figure 45 gives some suggestions on steps and process tools to generate added values through a retrofit. An abductive process captures the need to allow for site specific knowledge, for example the understanding of tenants needs or the detailed knowledge of the physical outline of the building, while at the same time using more general knowledge, for example regarding design solutions. An iterative process allows for initial suggestions to be evaluated on a theoretical level through the collective knowledge within a design team.

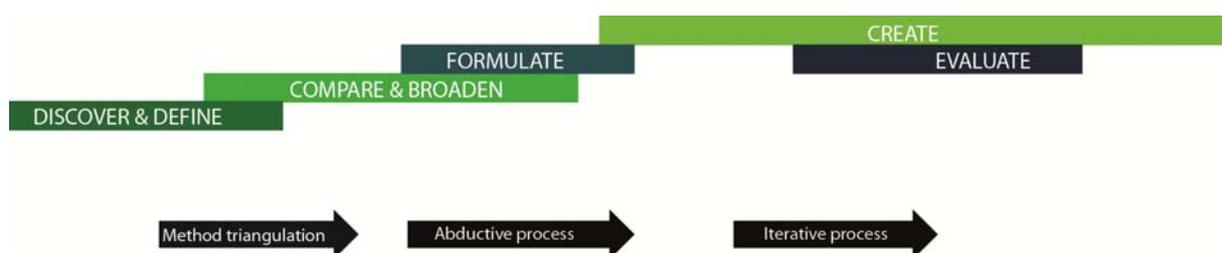


Figure 45: Framework of socio architectural method

¹⁵ Stake (1998) Cases studies. Chapter in: *Strategies of Qualitative Inquiry*.

The core lesson, building on the evaluation conducted within the task, is that social value increases can harmonise with drastically decreased building energy consumption. But for this to take place strategies needs to be developed for the below listed aspects:

1. initial understanding of tenants needs;
2. strong communication and information channels before and during retrofit;
3. post retrofit information and communication for supporting tenants adaptability to a new living situation.

6 Some Final Thoughts Regarding further Research

The method for evaluating social impacts developed within the task and the results presented in this Deliverable is no final solution or error free interpretation of the data it generated. For sure the aspects and indicators used leaves room for improvements. But this is a step towards increasing the understanding of how to integrate social aspects within, and evaluating social impacts generated by, a retrofit. There is need for further research juxtaposing value chains generated by a retrofit and further expanding the holistic approach of the E2ReBuild.

Europe is growing older and the adoptability of future tenants to the distress generated by a retrofit and the new living situation it creates poses challenges for future retrofits. This fact further stresses the need to understand and adopt strategies taking into account the needs of tenants. During the fieldwork conducted within this project several aged tenants were interviewed and results indicated a lower acceptance toward temperature changes and a lower degree of adaptability to new a new living situation and the social fabric surrounding it. This is an aspect further research might expand on, given an aging European demography and the continuing need to retrofit an aging European building stock.

Appendix A Tenant Questionnaire

Dear Sir/Madam

This questionnaire is part of a research programme, E2ReBuild, aiming at finding new retrofit solutions for more energy efficient buildings and improved living environments for residents. Your building is one of the seven demonstration projects in this programme. In the demonstration buildings, new solutions for reducing the energy consumption, improving the indoor climate and creating attractive built environments, are demonstrated. To determine how well different solutions work, we are interested in learning more about how you experience your apartment/house and your surroundings. By filling out this questionnaire, you give us valuable information about how we can improve the design, operation and use of buildings in new retrofit projects. The information from your answers will be analysed and used in the evaluation of the retrofit strategy for your building. Your participation is very important to us! Please note that your answers will be treated under strict anonymity.

You can leave the completed questionnaire to XX at yy!

If you have any questions about the questionnaire, please do not hesitate to contact us:

AA, demonstration leader, E2ReBuild, e-mail: a.a@b.cc , telephone: 555 666 7777

XX, yy, Housing company, e-mail: x.x@housingcompany.cc , telephone: 555 666 7777

About E2ReBuild

E2ReBuild stands for "Industrialised energy-efficient retrofitting of residential buildings in cold climates". During three and a half years the retrofit of seven residential areas in Finland, France, Germany, the Netherlands, Sweden and the United Kingdom will be used to investigate, demonstrate and promote advanced, cost-effective, energy-efficient retrofit strategies. The programme is a collaboration project co-financed by EU FP7 and the 20 participating partners. The expected result is a holistic industrialised retrofit process that minimises technical and social disturbance for tenants, facilitates energy-efficient operation and use and encourages energy-efficient behavior. The partner group includes several universities, research institutes, construction companies, public and private housing companies, architect firms and energy consultants.

Learn more about E2ReBuild at www.e2rebuild.eu

Instruction for answering the questionnaire

Please fill in the questionnaire according to how you perceive and evaluate your living situation and the retrofit process and its outcome. Most questions are answered by marking the circle which corresponds best with your situation or attitude. Some questions are further open for you to write an answer on the printed lines.

Many of the questions asks you about the situation before and after the retrofit, please then fill one circle before and one after, as shown in the example (in the example the circle to the far left indicates very poor access, to the far right excellent access). The questionnaire ends with a section where you can write further comments. If there are several persons in the household, please choose one who complete the questionnaire.

On behalf of (company) and E2ReBuild we thank you for taking the time to give us your feedback!

How many years have you lived in the neighbourhood? 1-2: <input type="radio"/> 3-5: <input checked="" type="radio"/> 6-10: <input type="radio"/> 11-15: <input type="radio"/> 16 or more: <input type="radio"/>				
What motivated you to move here? <u>Here you write your answer.</u>				
<u>Here you write your answer. Here you write your answer.</u>				
<u>Here you write your answer.</u>				
EXAMPLE				
<table border="0"> <tr> <td style="text-align: center;">Before retrofit (very poor - excellent)</td> <td style="text-align: center;">After retrofit (very poor - excellent)</td> </tr> <tr> <td style="text-align: center;"> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/> </td> <td style="text-align: center;"> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/> </td> </tr> </table>	Before retrofit (very poor - excellent)	After retrofit (very poor - excellent)	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>
Before retrofit (very poor - excellent)	After retrofit (very poor - excellent)			
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>			
Access to natural light?				

Company logo, demo

E2ReBuild

Apartment number:

A. BASIC INFORMATION

1. Address? _____
2. Age? 16-24: 25-34: 35-44: 45-54: 55-64: 65 or more:
3. Gender? Male: Female:
4. Number of persons in the household? 1: 2: 3: 4: 5: 6 or more:
5. Apartment/house square meter area? _____
6. Number of rooms? 1: 2: 3: 4: 5: 6 or more:
7. Floor? 1: 2: 3: 4: 5: 6 or more:
8. How many years have you lived in your apartment? 1-2: 3-5: 6-10: 11-15: 16 or more:
9. How many years have you lived in the neighbourhood? 1-2: 3-5: 6-10: 11-15: 16 or more:
10. What motivated you to move here? _____

B. WELL-BEING AND HEALTH

How satisfied are you with the following aspects regarding your apartment/house indoor environment:

	Before retrofit (very poor - excellent)	After retrofit (very poor - excellent)
1. Overall indoor comfort?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
2. Access to natural light?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
3. Noise protection (from within building)?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
4. Noise protection (from outside building)?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
5. Summer temperature?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
6. Winter temperature?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
7. Indoor wall temperature?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
8. Draught from windows?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
9. Air quality (particles of dust and dirt)?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
10. Air quality (smell)?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
11. Indoor moisture?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
12. Kitchen equipment standard?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
13. Bathroom equipment standard?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

C. EXPERIENCE OF THE BUILT ENVIRONMENT

How would you respond to the following statements:

	Before retrofit (fully disagree - fully agree)	After retrofit (fully disagree - fully agree)
1. Quality of life is high in my apartment/house	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
2. Quality of life is high in my building	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
3. Quality of life is high in my neighbourhood	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
4. I'm happy with my apartment/house size	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
5. I'm happy with my building size	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
6. I feel safe in my apartment/house	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
7. I feel safe in my building	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
8. I feel safe in my neighbourhood	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
9. I feel proud of my apartment/house	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
10. I feel proud of my building	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
11. I feel proud of my neighbourhood	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
12. The status of my neighbourhood is high	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
13. Where I live is important for my identity	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
14. My apartment is important for my identity	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
15. I feel a strong connection to where I live now	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
16. I belong to the community in my neighbourhood	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

17. How would you define quality of life in relation to your apartment/house, building neighbourhood (how do they contribute to your well-being)?

D. EVALUATION AND USE OF TECHNICAL SYSTEMS IN YOUR APARTMENT/HOUSE

Please specify the function and usability of the following installations in your apartment/house:

	(very poor		-		excellent)
1. Heat control functionality?	<input type="radio"/>				
2. Heat control usability?	<input type="radio"/>				
3. Ventilation control functionality?	<input type="radio"/>				
4. Ventilation control usability?	<input type="radio"/>				
5. Do you have the possibility to change your indoor temperature? Yes: <input type="radio"/> No: <input type="radio"/> No opinion: <input type="radio"/>					

E. EXPERIENCE OF ARCHITECTURAL QUALITY IN YOUR APARTMENT/HOUSE AND BUILDING

How would you rate the design of your:

	Before retrofit (very poor - excellent)	After retrofit (very poor - excellent)
1. Floor plan design in your apartment?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
2. Materials and surfaces?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
2. Windows?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
3. Light condition?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
4. Kitchen?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
5. Bathroom?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
6. Living room?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
7. Bedroom?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
8. Floor plan design of your building?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
9. Balcony?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
10. Staircase?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
11. Elevator?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
12. Roof?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
13. Building facade?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
14. Building entrance?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

F. RETROFIT DESIGN AND PROCESS

1. Which were your general expectations of the retrofit project? _____

How would you rate the following retrofit aspects: (very poor - excellent)

- | | | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 2. Communication before retrofit? | <input type="radio"/> |
| 3. Information distributed about the retrofit? | <input type="radio"/> |
| 4. Participation from tenants in the design phase? | <input type="radio"/> |
| 5. The suggested design proposal? | <input type="radio"/> |
| 6. Work in the apartment during retrofit? | <input type="radio"/> |
| 7. Value of retrofit in relation to rent level? | <input type="radio"/> |
| 8. Overall impression of retrofit process? | <input type="radio"/> |
| 9. Overall impression of retrofit outcome (the design)? | <input type="radio"/> |

10. Has enough information been provided to correctly use the building and its heating and ventilation systems? (fully disagree - fully agree)

11. Do you think its important for the tenants to participate and have an influence in the design phase of a renovation? (not important - very important)

12. Which is your general impression of the retrofit project? _____

13. From your perspective, which added values (positive aspects) was created from the retrofit?

14. From your perspective which decreased values (negative aspects) was created from the retrofit?

G. COLLABORATION AND PARTICIPATION CONCERNING YOUR APARTMENT AND BUILDING

1. Do you feel involved in decisions concerning your apartm./house? Yes: No: No opinion:
2. Do you feel involved in decisions concerning the building? Yes: No: No opinion:
3. Do you feel involved in decisions concerning the outdoor spaces? Yes: No: No opinion:
4. If you purchase new electronic or electrical appliances, do you consider energy consumption ? Yes: No: No opinion:

H. ENERGY BEHAVIOUR AND SUSTAINABILITY

1. Is your energy consumption an important aspect for you? Yes: No: No opinion:
2. Are you aware of your energy consumption? Yes: No: No opinion:
3. Are you interested in reducing your energy consumption? Yes: No: No opinion:
4. Would it be possible for you to reduce your energy consumption? Yes: No: No opinion:
5. Are you interested in getting information on how to reduce your energy consumption? Yes: No: No opinion:
6. How would you like to get information on how to reduce your energy consumption?
 - Through personal contact:
 - Through written information:
 - Through homepage:
 - Through phone application:
7. Has the retrofit made you more aware of your personal energy consumption? Yes: No: No opinion:
8. Do you have any electronic equipment on stand by when not used? Yes: No: No opinion:
If yes which ones? _____
9. Do you have any low-energy consuming equipment (for example low energy bulb) in your apartment? Yes: No: No opinion:
10. If yes which ones? _____
11. If you purchase new electronic equipment, do you consider energy consumption? Yes: No: No opinion:
12. Would you tolerate greater temperature differences in your apartment throughout the day? Yes: No: No opinion:
13. Approxiamately how often during the colder season (september-april) do you open a window for ventilation purposes?
 - Daily: Once or twice a week:
 - Once or twice a month: A few times a year:
 - For how long time? a few minutes about an hour a few hours

