



Working paper:
**Literature review of key stakeholders,
users and investors**
D2.4. of WP2 of the Entranze Project

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	EEG	Energy Economics Group, Institute of Energy Systems and Electrical Drives at Vienna University of Technology
	NCRC	National Consumer Research Centre
	Fraunhofer	Fraunhofer Society for the advancement of applied research
	CENER	National Renewable Energy Centre
	eERG	end use Efficiency Research Group, Politecnico di Milano
	Oeko	Öko-Institut
	SOFENA	Sofia Energy Agency
	BPIE	Buildings Performance Institute Europe
	Enerdata	Enerdata
	SEVEn	SEVEn, The Energy Efficiency Center

The ENTRANZE project

The objective of the ENTRANZE project is to actively support policy making by providing the required data, analysis and guidelines to achieve a fast and strong penetration of nZEB and RES-H/C within the existing national building stocks. The project intends to connect building experts from European research and academia to national decision makers and key stakeholders with a view to build ambitious, but reality proof, policies and roadmaps.

The core part of the project is the dialogue with policy makers and experts and will focus on nine countries, covering >60% of the EU-27 building stock. Data, scenarios and recommendations will also be provided for EU-27 (+ Croatia and Serbia).

This working paper constitutes Deliverable 2.4 of the ENTRANZE project and presents the main results of Task 2.4 (Investigate the structure of stakeholders, user and investor groups and their behaviour, preferences and interests).

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EXECUTIVE SUMMARY

Introduction

This working paper constitutes Deliverable 2.4 of the ENTRANZE project and presents the main results of Task 2.4 (Investigate the structure of stakeholders, user and investor groups and their behaviour, preferences and interests). ENTRANZE is funded by the Intelligent Energy Europe programme and aims to actively support policy making by providing data, analysis and guidelines to achieve a fast and strong penetration of near-zero-energy buildings (NZEB) and renewable heating and cooling (RES H/C) within the existing national building stocks.

One key aspect in developing successful policies is knowing the way in which building owners, users and other stakeholders in different countries react to policy measures. There are great differences among countries, as well as among owner types, which may be very important for the success of European policies. The objectives of this report are to:

1. Make a classification of the relevant stakeholders with regard to investment decision making and user behaviour.
2. Identify the stakeholder-specific barriers to the application of energy efficient technologies and describe the causal relationships between certain constraints and investment decision making.
3. Identify similarities and differences in investment decisions among the target countries.

ENTRANZE is a European project that in principle covers all EU-27 countries. However, the geographical scope of the project is divided into target countries, focus countries and other countries. In terms of this scope, this deliverable (D2.4) focuses on the nine target countries: Austria, Bulgaria, Czech Republic, Finland, France, Germany, Italy, Romania and Spain. ENTRANZE D2.6 will provide a more aggregated assessment for the focus countries and a rough assessment for these issues concerning all EU-27 countries.

This deliverable does not focus explicitly on particular technologies for NZEB renovations or RES-H/C. Rather, it aims to provide an initial overview of the issues and players, and particular solutions such as insulation, heating systems or ventilation are mentioned only as examples. In contrast, a particular focus on the public acceptance of different technologies and solutions will be presented in ENTRANZE D2.6. The generic term “energy renovation” is here used to refer to several types of investments, including thermal insulation, measures related to heating and ventilation systems and on-site renewable energy production.

Perspective and methods of the study

When considering decisions to invest in energy efficiency or on-site renewable energy production, it is important to recognize that such decisions are not separate from other decisions concerning the building and its users. Energy investment decisions are embedded in existing structures of decision making, information use and institutional and social norms concerning building maintenance and renovation. Moreover, they are part of the overall financial, legal and infrastructural context of building owners and users.

When classifying building owners with regard to decision making and behaviour, building and dwelling ownership and tenure is a key categorization. Common categories include owner-occupied buildings, privately rented buildings and non-profit rented buildings. Moreover, building type can determine the structure of decision making. Decision making is relatively simple if there is one owner per building, but more complex if owners are dependent on each other to reach a decision on renovating the building. A dominant feature in some European countries is collective ownership-occupancy of multifamily buildings, which is differently organized in different countries. Similarly, the share and ownership of rental buildings varies greatly among European countries, as do rules concerning tenants’ rights and obligations.

Drawing on this classification, stakeholder specific barriers have been considered. This has been done with the use of a generic classification of commonly observed barriers into (1) genuine uncertainties regarding cost-effectiveness, (2) financial barriers, (3) organisational problems, (4) lack of information and skills, (5) transaction costs and (6) other barriers that may be context-dependent.

In addition to stakeholder-specific barriers, D2.4 has also aimed to identify the main drivers for energy renovations, i.e., factors stimulating or encouraging building owners to make energy renovations, such as concerns over rising energy costs, environmental concerns, the desire to improve comfort, or particular opportunities to make energy efficiency investments. Drivers also include public policy measures that make energy renovations more popular in society. On a basis of this analysis, the study has further attempted to determine the most important decision criteria for each decision-maker category in each country.

In our analysis of barriers, preferences and investment behaviour, we have primarily taken the building owners' perspective, as they are the party making final decisions on their property. However, we also acknowledge that building owners are influenced by other stakeholders. For example, in some cases, tenants or facility managers may be the drivers of energy investments, whereas in other cases, stakeholders such as tenants or e.g. banks may present barriers to energy investments. Because of limited time and human resources allocated to this task, the research conducted in Task 2.4 has focused on identifying and filling in knowledge gaps. This has been done through the following stages:

1. Identification of knowledge base and initial judgements of project partners on stakeholders and their key barriers and drivers. This has been done with a questionnaire to partners concerning their initial view of the roles of various stakeholders, barriers and decision criteria for each building type-owner combination, as well as suggestions for research literature and experts to interview in their country.
2. Refinement and redefinition of relevant owner categories for each country. This was done primarily on the basis of (a) the share of particular owner types in terms of total building area and (b) existence of information on distinct decision profiles for a particular owner type. As a result, some owner type categories were divided into several sub-categories and conversely, some were combined.
3. A literature review to confirm or disconfirm and specify initial judgements of project partners. In addition to the literature review, an extensive review of available national and European statistics, European framework projects and Intelligent Energy Europe projects was conducted. This review indicated that indeed, fairly much is known about certain stakeholders in certain countries, but not about each stakeholder in each country. The scope and quality of existing data and literature was not always very satisfactory; moreover, some things have changed quite significantly in recent years in many countries. Hence, the results of the literature review are indicative rather than conclusive.
4. Expert interviews to fill in the most important gaps. For each target country, 3-4 experts have been interviewed to fill in the most important data gaps and to gain the experts' views on each owner group's most important barriers and decision criteria in their country. These expert interviews were used to (1) complement the qualitative data offered by the literature review and bring in new information on barriers and investor decision making and (2) to get a third, fourth etc. opinion (in addition to our own partners' and the literatures' views) on the "most important" barriers and decision criteria for each owner group. The types of experts selected for the interviews depended on the specific information needs for each particular country. They include policy makers, researchers, experienced practitioners, building owner associations and building owners.
5. The expert interviews offered a great deal of data and specific insights from each country, as well as a wealth of new issues to be considered (these are reported in each chapter) and many suggestions for how the situation could be improved. Unfortunately, many of the experts were not able to comment on all of the owner groups, as their experience was often limited to certain groups of building owners. The task of identifying "the most important" barriers and decision criteria also proved to be difficult, as there can be quite a wide variance within a certain owner group.
6. The expert interviews were documented, and analysed as follows: We considered the consistency of different experts' views and the degree of confidence they expressed in their views, the evidence from which they drew their viewpoints, the logic of their judgement, and the extent to where they agreed or disagreed with each other and the literature. This forms the basis of our identification of what are deemed the "most important" barriers and decision criteria for each owner group in each country.

There are thus several limitations to the results of this study. However, the results obtained are the best that could be achieved with limited time and budget, considering the broad scope expected from this study. Compared to the initial status of knowledge, they represent a distinct step forward.

Findings: Structure of ownership and decision making

There are significant differences in the structure of ownership and decision making among the target countries. Owner-occupied single-family homes are the only category that is fairly similar in all countries. Shares range from 20 – 57% of the total building area. However, there are differences in owner demographics and sub-categories of owners. In several countries, owner-occupied single-family homes are the most dominant and normal type of home in urban (or at least suburban) areas, whereas in others, they mainly occur in rural areas and in wealthy suburban villa areas. So the homogeneity between countries to some extent masks heterogeneity within countries. We have tried to capture this diversity to some extent through sub-categories, which are presented in the specific country chapters. Most single-family homes in Europe are owner-occupied, but the share of rented single-family homes varies greatly.

The differences in ownership structure are much greater still in multi-family buildings. Here, some countries have a predominant share of owner-occupancy (Table 1). Further, the structure of decision-making within owner-occupied apartment buildings varies greatly. This pertains to the majorities needed for making decisions on renovations, to the ability of co-owners to obtain loans for renovations, to the existence and usefulness of renovation funds, and to the professionalism with which buildings are managed. A problem highlighted in our study is that in several countries, irrespective of the majority required to make decisions, the financing of investments with a bank loan may require that all owners mortgage their own apartments.

Table 1. Share of owner-occupancy in multifamily housing and required majorities for decisions

	Share of owner-occupied, % of multifamily dwellings	Type of ownership ¹	Required majority for decisions on renovations, %	Other factors influencing renovations
Austria	23	unitary system	>50% of shares, but minority rules	The minority rules. Mandatory renovation fund usually not big enough. Joint loans have a big administrative burden.
Bulgaria	90	condominium ownership/unregulated	>67% (of area)	All buildings do not have a homeowners' association. When no homeowners' association exists, each owner needs a separate loan.
Czech Republic	79	condominium ownership	>75% of votes	Banks usually require that all apartment owners mortgage their apartments for the loan.
Germany	24	condominium ownership	>50% of shares	Mandatory renovation fund (1% of value of building). Taking out a loan can require a mortgage by all residents.
Finland	50	housing company (similar to unitary system)	>50% of shares	The housing company can take out a loan of its own, once the majority of owners have agreed to it.
France	26	condominium ownership	>50% of shares	Taking out a loan can require a mortgage by all residents.
Italy	65	condominium ownership	>50% of shares (for energy investments)	Dissenters can move to delay the implementation of decisions with significant financial consequences.
Romania	96	condominium ownership?	>67%	Taking out a loan can require a mortgage by all residents.
Spain	86	condominium ownership	> 50% of shares	Can be less for renewable energy (1/3), but those voting against cannot be charged. Taking out a loan can require a mortgage by all residents.

Source: own compilation, references presented in previous chapters

In all of the countries, however, in owner-occupied apartment buildings, lay people make decisions on very large and very challenging investments when they decide about renovations of the entire building. In general, co-ownership of multi-family buildings is a problem that has received insufficient attention in the

¹ The unitary system refers to an undivided apartment building, of which owners own shares. Condominium ownership refers to a system where the owners own their dwelling and all owners jointly own the common parts and the land (Lujanen 2010).

European discussion on energy renovations. It seems that simple measures, such as grants for renovations, are often not sufficient to stimulate energy renovations even in countries where they are extremely generous. Issues such as decision making rules, repair and maintenance funds, tailored financial services and professional maintenance and repair plans need to be addressed. The picture is further complicated by the fact that in some countries, a relatively large share of the rental apartments are owned by private persons with one or a few rental apartments co-located in buildings with owner-occupied apartments.

A particular problem is **owner-occupancy by low-income households**. There are low-income homeowners in all the target countries; however, the significance of this depends on both the overall share of owner-occupancy and the share of low-income households among owner-occupants. The overall share of owner-occupants varies from less than 60% in Austria and Czech Republic to more than 80% in Spain, Bulgaria and Romania (with Finland, France and Germany having a share that is between 60 and 80%). Figure 1 shows the share of low-income households among owner-occupants in the ENTRANZE target countries in 2008, with low-income defined as earning less than 60% of the median income. Problematically, in countries where almost everyone is a homeowner, the share of low-income households among homeowners is particularly high (15-25%) and the total group is thus large. Low-income homeowners are unlikely to be eligible for commercial retail loans because their income is not sufficient to pay for the monthly repayments.

Other problematic categories of building owners include **elderly people and pensioners**. These were often mentioned by our expert interviewees or in the literature as owner types that are less likely than others to make major renovations. There are several reasons for this, such as shortened time-horizons (they are unlikely to benefit from renovations during their lifetime or time living independently at home). On the other hand, some renovations can be necessary for them to adapt to living at home with disabilities. In many countries, pensioners have difficulties gaining loans (at least larger ones) due to lower incomes and higher repayment risks. Our country studies also suggest that in several countries, there are areas where the **value of the property is so low that properties are unlikely to be eligible for market-based finance** to invest in renovations. Our interviewees also mentioned buildings that are in **poor structural condition** (e.g. pre-earthquake buildings in Romania) as buildings that might not merit major renovations.

The ownership of rental apartments differs greatly among the countries examined. In general, in countries where rental apartments are scarce, there are more problems for energy renovations, as the rental apartments only house the very poorest people, and there are legal or practical constraints on adding any of the renovation costs to the rent. In these cases, the landlords are in a very difficult situation, especially as the value of the buildings is low and their future is uncertain. In other countries with a large share of well-established rental social housing providers, energy renovations may be easier to initiate in rental than in owner-occupied apartments, due to the concentration of power, systematic renovation schedules, and e.g. determined public policies (Austria, France, Finland).

Public buildings also exhibit a great diversity, both among and within countries. One issue is the competences of the state versus municipalities. In many countries, municipalities own a large share of the public buildings, and some of them (especially small municipalities) are in a precarious financial situation. However, the current poor state of public finance is a common problem in all countries at the moment. Moreover, public budgeting procedures and the practice of having separate budget lines for running expenses and investments are widespread problems, as is the fact that investments in energy efficiency have to compete for budget funding with other (often more visible) investments. Some countries have made determined efforts to overcome these problems, for example by supporting and facilitating third-party finance (ESCOs and EPC), which is, however, in an early stage of development at best.

Office buildings are a group that is more homogeneous across the target countries, at least as pertains to professionally owned office rental office properties, which are sometimes even owned by multinational companies operating in several European countries. Even here, however, differences in the market structure and the preferences of the clientele can create differences. A common issue in most countries,

however, is the fact that even energy aware property owners may prefer to take energy efficiency measures in new office buildings and in operations and maintenance, rather than through renovations.

Apart from the differences between buildings types and ownership types, our analysis identified a further, partly related dimension that has relevance for energy renovations and the criteria considered when making such decisions. This is the level of *professionalism* with which buildings are managed. Higher professionalism does not necessarily imply a greater propensity to make energy renovations, but it implies that different decision criteria (i.e., measurement and verification of savings, returns on investment and the financial value of time) are relevant in the decision making process.

Findings: Barriers and decision criteria

The overall situation in a country creates some conditions that influence all different owner types. For example, in the new member states (Bulgaria, Czech Republic, Romania), especially financial and organizational barriers to energy renovations appear to be more severe than in other target countries. Similarly, the conditions of the financial austerity measures are creating financing problems in Italy and Spain. In a relatively stable financial environment and over a longer period, public policy can however create an overall climate that is conducive to energy awareness and also stimulating energy renovations (Austria, Germany, France).

Consistent and long-term policies should in principle also create competencies and markets for services that are not exclusive to one particular owner group. However, this is not necessarily reflected in stakeholders' perceptions of transaction costs. There are most likely certain problems in comparing our data across countries (i.e., when the relative importance of a problem like finance declines, other problems like transaction costs become relatively more important). However, it is at least suggestive that we found problems concerning the lack of skilled service providers, high information search costs and risks of renovations in all countries, even those with quite some experience of energy renovations.

However, as noted above, the situation of different stakeholders (owner-occupiers and landlords of different types of buildings) creates different conditions for making decisions on energy renovations. There are thus some similarities to be observed among stakeholder types in all target countries. Table 2 presents the critical barriers for owner-occupiers of single-family homes. We can see that high initial costs are a common critical barrier. Access to capital or the high cost of capital is also a critical barrier in 8/9 of the countries, as are long payback times of energy investments. In contrast, issues relating to genuine uncertainties, lack of information and skills, and transaction costs are perceived differently in the target countries. This is most likely due to the status of the public debate, the availability of off-the-shelf cost-effective solutions, and the accessibility of energy advice. It also likely relates to the status of the housing and the owners' expectations: if the original state is poor, for example window replacement can make a big difference (whether or not the exact costs and benefits can be calculated), whereas when the condition is better, there are more genuine uncertainties and competing solutions creating transaction costs for owners.

Table 3 displays the critical barriers to energy renovations for owner-occupied apartment buildings according to literature review and expert interviews. A common barrier in all countries is the collective decision problem. High initial costs and/or long payback times are also widespread barriers. In general, there appear to be more barriers and problems for this owner category, because the collective nature of the decision requires more detailed calculations, and directs more attention to uncertainties and transaction costs. Some problems, however, are not critical barriers in certain countries: access to capital is not a critical issue in Austria, Finland or Germany, where there are provisions for either reserve funds or collective bank financing.

Table 2. Owner-occupied single-family homes: The most critical barriers in target countries

	AT	BG	CZ	DE	FI	FR	IT	RO	ES
Conflicting information, mistrust of information									

tenant dilemma is another fairly widespread barrier. It is not however a major problem in Austria and Finland due to the way in which costs and benefits are distributed among owners and tenants.

Table 13.4. Social/professionally owned rental housing: The most critical barriers in target countries

		AT	BG	CZ	DE	FI	FR	IT	RO	ES
Genuine uncertain	Conflicting information, mistrust of information		■	■				■		
	Heterogeneous outcomes								■	
	Uncertainty in measurement & verification		■	■				■		
Financial barriers	High initial costs		■				■	■	■	■
	Long payback time		■	■	■	■	■	■		■
	Access to/cost of capital		■				■	■	■	■
	Unwillingness to incur debt		■					■	■	■
	Occupant take-back		■		■			■		■
	Low/uncertain resale value of property				■			■		
Organizational problems	Landlord-tenant dilemma		■	■	■		■	■	■	■
	Collective decision problems		■	■				■		
	Short timeframe of decisions		■	■						
Lack of information & skills	Lack of customer attention and interest		■					■	■	
	Lack of customer knowledge		■	■				■		
	Lack of reliable advice								■	
Transaction costs	Lack of skilled service providers	■						■	■	
	High information search costs							■		
	Switching costs, concerns over disruption	■				■				
	Risks of failures in renovation	■	■				■			

Source: Own compilation, see previous chapters

Public buildings are presented here as a fourth example of similarities and difference among owner groups across countries (Table 13.5). A common problem that does not seem to have been solved in any of these countries relates to public budgeting practices. In particular, this refers to the way in which public-sector organizations have separate budget lines for investments and running costs. Several countries have tried to solve this by using EPC or ESCO contracts, but until now, progress does not seem to have been significant. Another widespread barrier relates to the high initial costs of energy investments (8/9 of the countries). Moreover, even public sector organizations in many countries seem to have problems in accessing capital for investments (especially in the current financial situation).

Other problems seem to be more specific to particular countries and the way in which, for example, energy management and energy investments are organized, as well as the size of contracting units. An additional problem mentioned by several of our interviewees relates to public tendering rules and practices: often, initial cost is the main criteria in the tender, and lifetime costs are difficult to include in the award criteria. One of our interviewees suggested the development of a new standard tendering model that focuses on lifetime costs.

Table 13.5. Public buildings: The most critical barriers in target countries

		AT	BG	CZ	DE	FI	FR	IT	RO	ES
Genuine uncertainty	Conflicting information, mistrust of information									
	Heterogeneous outcomes									
	Uncertainty in measurement & verification									
Financial barriers	High initial costs					*				
	Long payback time									
	Access to/cost of capital					*				
	Unwillingness to incur debt									
	Occupant take-back									
	Low/uncertain resale value of property					*				
Organizational problems	Landlord-tenant dilemma									
	Collective decision problems									
	Short timeframe of decisions					*				
	Public budgeting practices									
Lack of information & skills	Lack of customer attention and interest					*				
	Lack of customer knowledge					*				
	Lack of reliable advice					*				
Transaction costs	Lack of skilled service providers					*				
	High information search costs					*				
	Switching costs, concerns over disruption									
	Risks of failures in renovation									

Source: Own compilation, see previous chapters

*= small municipalities

As concerns decision criteria, almost all building owners in Europe, barring some of the more stable professional building owners, give a **priority in their decisions to initial cost**. This is due to several reasons. Unsophisticated financial analysis is one issue, but this is not only the building owners' fault, and cannot be dispelled merely with better information. It is also due to genuine uncertainties about any other financial indicators, about which there generally are no guarantees.

The importance of initial costs is also due to the surrounding institutions, such as the lack of well-suited financial services. For example, a large share of European households are unable to finance energy renovations with their savings and need credit for their energy investments. While savings rates are high in many countries, these are used for investments in property (e.g. acquisition of homes and payment of mortgages), and in many countries few households have surplus savings for investments in energy renovations. Among the target countries examined here, only Austrian, German, French and Italian households, on average, actually have money in the bank or other financial securities that could be used for renovations. In other countries, on average, households must turn to a bank for a loan. Banks are not eager to offer finance, or interest rates are high in several countries and for several types of investors. Within this aggregate uncertain context, there are large groups of people and renovation projects that are not at all bankable. Moreover, financial institutions cannot identify which projects are bankable and which are not, so they can refuse even sound applications.

Improved comfort and **energy costs savings** are major drivers for renovation in several countries. Apart from some exceptional situations, however, merely energy cost savings are usually not sufficient drivers to

launch a major renovation. Improved comfort and better living or working conditions were often the most important criterion, and in some countries, also aesthetic aspects. The inclusion of energy aspects into planned renovations seems to depend greatly on government support programmes, such as **grants, tax deductions and low-interest loans**. These seem to make a difference in both countries that are struggling financially and in countries where building owners are financially stable. In particular, they seem to influence the **type and scope of energy improvements** included in the renovations.

Timing vis-à-vis previous renovations is a factor that is really important in some countries and for some kinds of building owners and almost irrelevant for others. This appears to depend on the renovation history of the buildings and on the historical existence of more-or-less standard renovation schedules. In countries where there has been virtually no renovation for decades, the previous renovation does not make a difference. However, the technical need to make a renovation is a key driver of renovation in all countries (even though this “need” is perhaps measured somewhat differently). There are, however, also other occasions for renovation, such as the change of ownership of a property (especially single-family homes). For most kinds of more comprehensive energy renovations, linking this to either an otherwise “necessary” renovation or to a change of ownership is almost a prerequisite. Timing is hence of utmost importance.

This said, there are differences among single-family homes and apartment buildings in how renovations are usually done. Several country studies revealed that renovation is often a continual **step-by-step process in single-family homes**. This is often connected to a more-or-less do-it-yourself mode of renovation, which is common in most rural areas and also in urban ones in some countries. This does not mean that owners perform all of the work themselves, but they can also contract builders or installers for part of the work. Some of our interviewees were very critical of this kind of piecemeal renovation, but others believed it to be an unavoidable fact of life and a necessary starting point for further development.

The situation in most apartment buildings is very different. Renovation of the building is a rare occurrence, which in most owner-occupied apartment buildings in Europe involves a great deal of anxiety, debates and concerns – very often, among owners with widely divergent interests, including owner-occupants, absentee owners of one rented apartment, young families and elderly pensioners. Organizational problems are key, and these have several facets (psychological, social, economic, legal and practical), which also have a bearing on the financial barriers and also intensify the transaction costs, such as concerns over disruption and risks of failure.

The role of **widely used solutions** also varies among countries, and here the differences may also relate to interpretation of what this criterion means. The availability of solutions that are relatively standard was seen in many countries to reduce both perceived and real risks, such as search costs and the risks of failure. Moreover, in some countries, the existence of standard models for certain building types was mentioned as a major facilitator of renovations. In addition, the literature and many interviewees highlighted the important role of real-life examples and peer-to-peer learning in the diffusion of energy efficient solutions.

Policy implications

In the light of our review of building owners’ decision making and their barriers to energy renovations, there is still a long way to go before deep and comprehensive energy renovations become widespread throughout Europe. Awareness and motivation are not sufficient to promote renovations, because the barriers are more structural and deep-seated.

Energy improvements are today mandatory in several countries when major renovations are made, and they are mandatory under other conditions in certain countries. Even in these cases, however, engagement of the owner-occupants is necessary. Our cases show that owners can block or severely postpone even technically necessary renovations. Moreover, when renovations are finally made, the owners have a large impact on what energy efficiency improvements are included and how well they are implemented. Further legislation, but also new ways of engaging residents are likely to be necessary to speed up the pace and improve the energy performance of renovations. A combination of well designed, locally available advice

schemes and the establishment of local and regional networks of qualified service providers have had a positive effect on renovations. Combinations of public advice and public-private finance have also shown good results. It seems that face-to-face advice and training are indeed a necessary condition for widespread and well-performed renovations, but not a sufficient one.

The role of initial costs is dominant in most countries among housing owner-occupiers (and several other groups as well). In some cases and to a certain part, this is due to the limited level of sophistication with which costs are assessed. Nonetheless, even in financially stable countries, there are problems in financial services, such as the relatively short loan periods offered by banks for owner-occupied apartment buildings. If the payback period of major renovations is more than 20 years, but loans need to be repaid in 5-10 years, annual costs are bound to rise when the building undertakes a major renovation. This makes the decision inconvenient and painful for owners.

Our literature review and interviews emphasized the role of grants in encouraging investments. The level of grants offered varies among countries from 15-80% of the total investment cost. Often, however, insufficient funds are budgeted and grant schemes run out of money. Most countries have several schemes, and consumers struggle to find out about the available options. In many countries, grant schemes change frequently, leading to confusion and at worst, aborting renovation plans that were already started. In some countries, payment of grants may also be badly delayed. Some interviewees were also critical of indiscriminate state support to renovations without particular energy standards or monitoring of savings achieved. One may also ask whether grant schemes that change annually lead to market failures and increase the price of renovations, as the supply of renovation services never has time to adapt to demand. The situation is not expected to improve as many countries are currently struggling with budget deficits.

However, grant schemes that are combined with advisory services, technical support and supplier certification have shown particularly good results. Moreover, grant schemes that require a combination of measures have at least in some countries led to more comprehensive renovations. One might hence conclude that grant schemes can be part of the solution, but need to be adequately budgeted over several years, well planned and delivered consistently. Our interviewees also stressed the importance of other financial instruments, such as tax incentives, soft loans, ESCOs and energy savings obligation schemes for energy providers.

Policy measures should also be targeted to “windows of opportunity” for energy renovations. The change of ownership of buildings is one such opportunity, which is to some extent already addressed by the energy performance certificates system. Elderly people (often seen as a problematic group) also have a need to renovate their homes for old age: this is another window of opportunity. In multifamily buildings and service buildings, such “windows of opportunity” may be more difficult to find. However, the opportunity to combine energy savings with other benefits is a major driver for renovations in all kinds of buildings and this should be better addressed in communications, support schemes and incentives.

The quality of renovations and the competence of the workforce were identified as a widespread problem almost throughout Europe, though its severity varies by country. Measures are underway in several countries and throughout Europe to build up competencies via training and certification. This is very necessary. However, if energy renovation rates are to be multiplied quickly, the problem of lacking workforce is likely to spread throughout Europe: if countries with currently low renovation rates are to recall their workforce, this is likely to lead to a lack of qualified workforce in the countries where there is a constant demand for renovations. Hence, while our study suggested that renovations among several owner groups can be facilitated via the provision of turnkey solutions and full-service packages, there may be a long way to go before these are widely available. Perhaps there is also a need for more step-by-step energy renovation models, at least for single-family homes. In the best case, these could be targeted at reaching a near-zero energy level over the course of several years.

1 Introduction

This working paper constitutes Deliverable 2.4 of the ENTRANZE project and presents the main results of Task 2.4 (Investigate the structure of stakeholders, user and investor groups and their behaviour, preferences and interests). ENTRANZE is funded by the Intelligent Energy Europe programme and aims to actively support policy making by providing data, analysis and guidelines to achieve a fast and strong penetration of near-zero-energy buildings (NZEB) and renewable heating and cooling (RES H/C) within the existing national building stocks.

ENTRANZE is coordinated by the Energy Economics Group from the Vienna University of Technology. Project partners include the National Consumer Research Centre (FI), Fraunhofer Society for the advancement of applied research (DE), National Renewable Energy Centre (ES), end use Efficiency Research Group, Politecnico di Milano (IT), Öko-Institut e.V. (DE), Sofia Energy Agency (BG), Buildings Performance Institute Europe (BE), Enerdata (FR), SEVEn, The Energy Efficiency Center (CZ). All partners have contributed to Task 2.4.

One key aspect in developing successful policies is knowing the way in which building owners, users and other stakeholders in different countries react to policy measures. There are great differences among countries, as well as among owner types, which may be very important for the success of European policies. This is the focus of Task 2.4. The objectives of this task are to:

4. Make a classification of the relevant stakeholders with regard to investment decision making and user behaviour.
5. Identify the stakeholder-specific barriers to the application of energy efficient technologies and describe the causal relationships between certain constraints and investment decision making.
6. Identify similarities and differences in investment decisions among the target countries.

Task 2.4 is closely connected to Task 2.5 (Public acceptance and perception of RES-H/C and energy efficiency in the building sector). The combined results of these two tasks will be presented in two forthcoming deliverables:

- D2.5 Database on stakeholders, investors and user types and their interests for each target country with clear interface and linkage to D2.2 (database of building sector and systems)
- D2.6 Report on specific features of public and social acceptance and perception of nearly zero-energy buildings and RES-H/C in Europe with a special focus on the target countries

ENTRANZE is a European project that in principle covers all EU-27 countries. However, the geographical scope of the project is divided into target countries, focus countries and other countries. In terms of this scope, this deliverable (D2.4) focuses on the nine target countries: Austria, Bulgaria, Czech Republic, Finland, France, Germany, Italy, Romania and Spain. D2.6 will provide a more aggregated assessment for the focus countries and a rough assessment for these issues concerning all EU-27 countries.

Moreover, this deliverable does not focus explicitly on particular technologies for NZEB renovations or RES-H/C. Rather, it aims to provide an initial overview of the issues and players, and particular solutions such as insulation, heating systems or ventilation are mentioned only as examples. In contrast, a particular focus on the public acceptance of different technologies and solutions will be presented in D2.6. Hence, the generic term “energy renovation” is here used to refer to several types of investments, including thermal insulation, but also to measures related to heating and ventilation systems and on-site renewable energy production.

The report is structured as follows: Chapter 2 presents an overview of building owners and stakeholders and the typology used for data collection. It also presents an overview of the most commonly observed barriers and drivers of energy renovations. These constitute the basis for the data collection, which is presented in chapter 3. Chapters 4-12 present the results as concerns the structure of stakeholders, user and investor groups and their behaviour, preferences and interests in each of the focus countries. Chapter

13 presents the summary and conclusions, and examines similarities and differences among countries and owner groups.

2 Typology of building owners and overview of barriers and drivers of energy renovations

When considering decisions to invest in energy efficiency or on-site renewable energy production, it is important to recognize that such decisions are not separate from other decisions concerning the building and its users. In contrast, energy investment decisions are embedded in existing structures of decision making, information use and institutional and social norms concerning building maintenance and renovation as well as who is making the decision. Moreover, they are part of the overall financial, legal and infrastructural context of the building owners and users. These are briefly outlined below in section 2.1.

It is widely held that there is a large untapped potential for cost-effective energy efficiency investments in Europe's buildings (de T'Sarclaes 2007; Eichhammer et al. 2009). A potential for cost-effective carbon emission reductions is likely also emerging in (at least some types of) on-site renewable energy production, as market prices for equipment are sinking while prices for fossil fuels rise.

However, there are also decades of evidence indicating that cost-effectiveness (from an engineering economics perspective) rarely determines investments in energy efficiency (Golove and Eto 1996). Many of the reasons for the "energy efficiency gap" relate to decision making in one way or another (Geller and Attali 2005): to the bounded rationality of building owners, to organisational problems/transaction costs or to imperfectly functioning markets. These are outlined in more detail in section 2.2., whereas section 2.3 presents an overview of the most commonly observed drivers of energy renovations and suggests an initial lists of the most common decision criteria.

2.1 Typology of European building owners and stakeholders

The landlord-tenant dilemma is often stated as one of the critical barriers to energy investment (e.g., Sorrell et al. 2004). Hence, building ownership and tenure is a key categorization of building owners and stakeholders. Following Meijer et al. (2010), we categorize between owner-occupied buildings, privately rented buildings (owned by property/real estate investors or private owners) and non-profit rented buildings (often called social housing, i.e., owned by housing associations or public bodies that operate on a non-profit basis). In some countries, there are also various in-between forms, such as right-of-lease housing. Because of this, the definitions of the categories vary to some extent between countries.

Moreover, there are also differences among European countries in terms of tenants' rights and obligations, as well as in how the costs and benefits of renovations are divided among owners and tenants. Issues that pertain to energy renovations include rent control (i.e., whether the owner of rental housing can shift the costs of renovations into rents), tenants' possibilities to veto renovations, and ways of charging for heating and hot water in centrally heated buildings (on the basis of usage or as part of the rent).

Because possible renovation measures are also expected to depend on the type of the building, residential buildings are further divided into single-family dwellings and apartment buildings (Meijer et al. 2009). Moreover, building type can determine the structure of decision making. Decision making is relatively simple if there is one owner per building (as is the broadly case in owner-occupied single-family homes or rental apartment buildings²). However, decision making is more complex if owners are dependent on each

² Of course, family dynamics play a role in single-family housing and e.g. governance or management dynamics can also play a role in professionally owned housing. However, the extent of complexity is somewhat less than in the case of multiple owners.

other to reach a decision on renovating the building. A dominant feature in some European countries is collective ownership-occupancy of multiapartment buildings (Lujanen 2010). It is traditional in Southern Europe, Bulgaria and Finland, and has become the norm in many (but not all) post-communist new member states. Moreover, the share of owner-occupied apartment buildings is growing in some other countries due to the privatization of the social housing stock (Tsenkova et al. 2009).

There are different rules of majority in decision making in different European countries, as well as differences in the rights and obligations of individual apartment occupant-owners, the housing/condominium association/company and its elected representatives, and housing managers employed to take care of the house (Lujanen 2010). Moreover, rules on quorums and majorities needed to make particular decisions, as well as on the rights and obligations of apartment occupant-owners, can significantly influence the possibilities for energy renovations (Guertler and Smith 2006; Lujanen 2010). There are basically two models of owner-occupation and joint ownership of a building, the condominium association and the unitary model, and these have different implications for the ease of making decisions about renovations as well as for the ease of financing renovations (Lujanen 2010). Very simply put, the building is one property and can be used as collateral for a loan in the unitary model, whereas the building is considered as several properties in the condominium model, and only the common areas are jointly owned. Hence, if a loan is needed for a major renovation, residents must usually mortgage their apartments.

We have also tried to divide rental housing into separate categories for commercial or co-operative rental housing and social rental housing. However, there is no pan-European definition of social housing and in fact, practices vary significantly by country. Moreover, in some countries, there is no or virtually no concept of rental social housing: for example in Spain, Greece and Cyprus, social housing is provided only or mainly in the form of low-cost housing for sale, and in some Central and Eastern European countries, rental housing in general is quite rare (CECODHAS 2012). Because ENTRANZE aims primarily to support policy processes on the national level, we have used somewhat different categories in different countries. For example, owner-occupied social housing is categorized as part of owner-occupied housing and the decision problems are similar (although they might be more severe), and municipally owned housing is considered in lieu of social housing in some countries where no definition of social housing exists.

Additional categories of buildings addressed in ENTRANZE include public buildings, which are further divided into buildings owned by the state and by municipalities. Local vs. central governments have different powers and resources in different European countries (CEMR 2011), and hence relevant stakeholders for energy renovations can vary. Moreover, the recently approved energy efficiency directive places requirements for a certain level of energy renovations in buildings owned by “central government”, whereas – after extensively protests by member states – buildings owned by local government were exempted from this requirement.

Office buildings are also examined, and here differentiated into owner-occupied and rented office buildings. The ownership and also the division of costs and benefits of energy renovations between owners and tenants has a significant influence on the emergence of landlord-tenant dilemma (de T’Sclarcles and Jollands 2007): the dilemma is not a problem if tenants pay the energy costs and can decide on renovations, nor is it a problem if owners pay the energy costs and can decide on renovations. Problems emerge in the (fairly common) case where the owner decides on renovations but tenants pay for energy costs. The level of professionalism in building ownership and management is also likely to influence the amount of attention that management gives to these issues.

Finally, we identify a category of “other” buildings. In this context, of particular interest are “mixed” buildings that are not uncommon in city centres. Such buildings might host owner-occupied apartments, privately or publicly rented apartments and/or small businesses (shops, workshops, offices). As different owners and users have widely divergent interests, such buildings may be particularly challenging for energy renovations. Another type of “other buildings” is second homes and/or empty buildings, which are considered in the following if they constitute a significant share of the building area.

The typology of building and owner combinations used in our data collection process is presented in Table 2.1. This table also raises key questions related to formal and informal influences on owners' decisions. Hence, key decision makers, collective decision forms and stakeholders (e.g. tenants) are identified. We have also tried to gain an overview of which parties can influence decisions legally, financially or through information. Finally, we have sought to identify key demographic features or categories related to each building and owner type combination.

Table 2.1. Building and owner type combinations and questions concerning stakeholder influence on decisions used in data collection for Task 2.4

	Residential							Public		Commercial office buildings		12. Other (e.g. mixed ownership buildings)
	Single-family, detached		Single-family, attached		Multi-family							
	1. Owner occupied	2. Rented	3. Owner occupied	4. Rented	5. Owner occupied	6. Rental private	7. Rental social	8. State	9. Local government	10. Owner occupied	11. Rental	
<p>Questions concerning each building-and-owner-type combination and to be covered in the country sections:</p> <ul style="list-style-type: none"> • Share of all buildings in m2 of total floor area? • Who makes energy investment decisions? • In the case of rental buildings, legal possibility to transfer investments into rent? • In the case of collective decisions, what kind of majority is needed? • Who can influence decisions legally? • Who can influence decisions through financial means? • Who can influence decisions through information? • Demographic features and potential demographic segments? 												

Source: Own compilation

In our analysis of barriers, preferences and investment behaviour, we primarily take the building owners' perspective, as they are the party making final decisions on their property. However, we also acknowledge that building owners are influenced by other stakeholders. For example, in some cases, tenants or facility managers may be the drivers of energy investments, whereas in other cases, stakeholders such as tenants or e.g. banks may present barriers to energy investments.

As stated above, different countries have different systems of building tenure. Hence, each chapter uses the national terminology as far as possible. The following are some terms referring to broadly similar (but not exactly the same) categories of building owners and users in different countries:

- **Single-family house** (or home) as a generic term refers to both detached and attached (or semi-detached, or terraced, or row) houses. In some countries, detached and attached houses are discussed separately, because they have different ownership and tenure systems. In some countries, statistics refer to broadly the same group with the term "1-2 family houses"
- **Owner-occupied apartment building** is here used as a generic term, along with owner-occupied multifamily building. These are also referred to in the following as condominiums when discussing the countries where this term is commonly used. They are governed by different bodies of owners in different countries: owners' assemblies, residents' associations, homeowners' associations, condominium (owners') associations, communities of property owners, or housing companies. Because the legal status of these bodies is not the same, different terms are used for different countries to refer to the decision-making body of these buildings.
- **Social housing:** We use the term social housing here only for rental housing, even though in several countries there is also state support available for building owner-occupied housing that is sold on certain social criteria. Since there is not common European definition of social housing, different terms and definitions are used for different countries. This can be e.g. "municipally owned

housing” or “public housing”. Eligibility criteria (e.g. income thresholds) for social or public housing are different in different countries.

- **Private rental housing:** This refers broadly to rental houses or apartments that are not distributed on social grounds, but available to anybody. They may be owned by private persons (owning one or several properties), professional real estate companies, or portfolio investors.
- **Other types of rental housing:** Rental housing can also be owned by co-operatives or other non-profit bodies.
- **Public buildings:** This term refers to buildings owned by public sector bodies such as the central government, states, provinces or regions, and municipalities or cities. The public sector is organised in different ways in different countries (e.g. healthcare or education can be provided by the central government, regions/provinces or the local government, or private companies or other organisations). We follow, as far as possible, the definitions used in each country.
- **(Commercial) office buildings:** Where not specified, the term ‘office buildings’ refers here to commercial office buildings, whereas public sector office buildings are part of the category ‘public buildings’. Commercial office buildings can be owned by the occupants or by private investors (professional real estate companies or portfolio investors).

There are several other parties influencing the decisions of building owners, such as house managers or administrators (employed to manage owner-occupied apartment buildings), various types of companies offering services (contractors, consultants, architects and engineering companies), as well as various public sector bodies (e.g. national or local energy agencies) and industry or owners’ associations. One additional new category of players referenced frequently in the following is energy service companies (ESCOs), which are defined in Directive 2006/32/EC as: “a natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user’s facility or premises, and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria.” Energy Performance Contracting (EPC) is a closely related term which is defined as “a contractual arrangement between the beneficiary and the provider (normally an ESCO) of an energy efficiency improvement measure, where investments in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement” (Directive 2006/32/EC).

2.2 Overview of barriers to energy renovations

There is a wide literature on barriers to energy efficiency investments, and several ways to categorize these barriers in different schools of economics (Golove and Eto 1996). The concept of “barriers” builds on the idea of an *energy efficiency gap* (Jaffe and Stevens 1994), whereby investment in energy efficiency is consistently lower than it should be when defined by various technological or social optimums. There has recently been much criticism of the concept of “barriers” (Guy and Shove 2000), as this implies some sort of individual deficit or departure from an assumed norm of energy efficiency (rather than a conflict between different societal norms), and suggests that the barriers are technical issues to be removed one by one (Bartiaux 2009). However, as the concept has become conventional and reflects real problems in society, we use it here to depict obstacles to energy renovations encountered by individuals, groups and societies.

We broadly follow here a categorization used by Uihlein and Eder (2009), and divide barriers into (1) genuine uncertainties regarding cost-effectiveness, (2) financial barriers, (3) organisational problems, (4) lack of information and skills, (5) transaction costs and (6) other barriers that may be context-dependent (Table 2.2). These are discussed in more detail below.

Genuine uncertainties regarding cost-effectiveness refer to the fact that even though cost-effective solutions can be identified in aggregate and in specific individual cases (de T’Sarclaes 2007; Eichhammer et al. 2009), it is not self-evident that the benefits materialize for each building owner and every type of investment decision (Golove and Eto 1996; Uihlein and Eder 2009). There is often conflicting information on the costs and benefits of energy efficient or renewable energy solutions in buildings. Competition between

marketing claims for different solutions can lead to mistrust of information, as can unsuccessful experiences from early experimental applications of solutions (Golove and Eto 1996). “Heterogeneous outcomes” refers to the fact that average savings in energy use may not materialize for individual building owners, depending on e.g. building characteristics or usage patterns (Uihlein and Eder 2009). Savings may also depend on interest rates and energy prices, which are difficult to predict. Finally, there may be uncertainties concerning measurement and verification of energy savings, which can be a concern particularly for external financiers of energy efficiency investments, e.g. energy service companies (ESCOs) or energy performance contracting (EPC).

Financial barriers are widely discussed in the literature. There is significant evidence suggesting that the high initial costs of energy efficiency investments are an overwhelming barrier for many individual homeowners, even for measures that are cost-effective in the long term (IEA 2008; Uihlein and Eder 2009). Moreover, private and even many corporate building owners use simple “rule of thumb” measures of cost-effectiveness, such as (relatively short) payback periods. Some building owners may have limited access to capital or a high cost of capital (e.g. because of low collateral values, low expected incomes or previous debt defaults), or they may be unwilling to incur debt due to personal or balance sheet-related reasons. Low or uncertain resale value of the property may also be a barrier to energy renovations in several ways: it may influence the value of the property as collateral for a loan and it also has a direct impact on building owners that anticipate selling their property in the near future. In the case of property that is rented, “occupant take-back” can be a concern: the expected savings might not accrue because tenants increase their comfort levels with e.g. higher room temperatures or ventilation rates. In general, it has been argued that investments in energy efficiency cannot be compared with investments in e.g. financial securities, because the former *usually* have much lower liquidity (Golove and Eto 1996).

Organisational problems serve here as an overall heading for principal-agent issues (de T’Serclaes and Jollands 2007) and problems of decision making on commonly held property. The “landlord-tenant dilemma” is one of the most widely discussed problems of “split incentives” (Sorrell et al. 2004), i.e., tenants would benefit from lower energy costs but landlords make the decisions on investments. On the other hand, as noted above, there are also collective decision problems related to multi-owner housing (Lujanen 2010). Also a short decision time-frame can be classified an organisational problem, as in this case, the owner might not make the best decision for the building, even though they might make decisions that suit their personal circumstances. For example, elderly people are often not eager to engage in renovations, and the same problem may concern tenants or owners who expect to move soon. In organisations, budgeting practices can also constitute an organisational problem (especially in the public sector), as running expenses and capital investments are treated differently. Often, the organisational level that would benefit from the energy efficiency investment does not have sufficient powers to make it.

Lack of information and skills constitutes a set of commonly acknowledged barriers. Energy issues are usually not a top priority on building owners’ and users’ agendas; hence, there may be limited customer attention and interest (Golove and Eto 1996; Uihlein and Eder 2009). Building owners might not monitor their energy consumption or costs, and might be unwilling to make the effort to learn about renovation options. If they surmount this barrier, there may be a lack of experts and resources or they may find it difficult to understand and process the available information. In addition to the cost of obtaining information, there is also a cost to using information. Thus, building owners are usually “boundedly rational”, i.e., they try to be rational, but in fact usually follow simple ‘rules of thumb’ (March and Simon 1958). Because of this, unsophisticated calculation rules (such a short simple payback periods) are often used instead of more sophisticated financial analyses. People may also simplify decision by only considering commonly used solutions (Wittman et al. 2006).

Transaction costs (or “hidden costs”) relate to the costs of information and the costs of monitoring and controlling economic exchanges (such as contracted renovation work). Typical examples include the lack of (or difficulty of identifying) skilled service providers (Uihlein and Eder 2009). Searching for the right information (and often employing external experts) to identify the best solution for each individual situation might be prohibitively expensive, especially at a point when outcomes are still uncertain.

Moreover, there are switching costs involved in any change. Renovations usually imply some level of disruption and need for relocation and can cause a stressful (and sometimes also expensive) disruption of everyday routines (especially for elderly or disabled people). Furthermore, there are risks in switching to a new solution. Even though there are risks in the *status quo* as well, these are usually not valued to the same extent (Thomson 1997; Tversky and Kahnemann 1979). Even in cases where risks of failure of the renovation are improbable *in aggregate*, they are real for the building owners and users: individuals have no way of knowing whether their particular renovation is the one that fails.

Table 2.2 Barriers to energy renovations investigated in ENTRANZE Task 2.4

1. Genuine uncertainties regarding cost effectiveness
<ul style="list-style-type: none"> Conflicting information, mistrust of information Heterogeneous outcomes Uncertainty concerning measurement and verification of energy saving
2. Financial barriers
<ul style="list-style-type: none"> High initial costs Long payback time Access to/cost of capital Unwillingness to incur debt Low/uncertain resale value of property Occupant take-back³
3. Organisational problems
<ul style="list-style-type: none"> Landlord-tenant dilemma Collective decision problems Short timeframe of decisions (e.g. due to short expected occupancy) Public budgeting practices
4. Lack of information and skills
<ul style="list-style-type: none"> Lack of customer attention and interest Lack of customer knowledge Lack of reliable advice Unsophisticated financial analysis
5. Transaction costs
<ul style="list-style-type: none"> Lack of skilled service providers High information search costs Switching costs, concerns over disruption Risks of failures in renovation
6. Other

Source: Own compilation, building on Uihlein and Eder 2009

As seen in the discussion above, it is difficult to maintain a sharp distinction between various categories of barriers, as they overlap and are often mutually reinforcing. There are genuine risks and uncertainties, but these are often compounded by the building owners' higher valuation of the risks of new solutions than the risks of the status quo, and further aggravated by the fragmented and underdeveloped market for energy renovations and the related financial services. There are also genuine limits to rational decision making due to the cost of obtaining and using information; because this is the case, many building owners use simple heuristics, postpone decisions, or follow the example of others. The overall operating environment in many European countries – in spite of significant advances in recent years – is not yet very supportive of energy efficiency investments. For example, the decades-long tradition of expecting short payback times from energy investments is not a feature of individual decision-making but a rule that is learned and reproduced in society as a legacy from former times when real energy prices were falling.

³ This might perhaps, in hindsight, preferably be a genuine uncertainty rather than a financial barrier.

It is unrealistic to expect building owners – especially households and small business – to structure problems and make decisions in exactly the same way as energy engineers, however much support and information they might gain. Other factors than energy, which is merely a service and a cost factor, are likely to have a greater weight in decisions on renovations. Moreover, the building owners' and users' perspective is fundamentally different from that of the energy engineer (Parnell and Popovics-Larsen 2005). However, even boundedly rational individuals can make decisions on energy renovations when supported by their environment. Alongside the barriers to energy renovations, there are also drivers, which are discussed in the following section.

2.3 Overview of drivers of energy renovations and owners' decision criteria

Several studies have investigated drivers for energy renovations. These are here defined as factors stimulating or encouraging building owners to make energy renovations (Huber et al. 2011; Thomsen et al. 2009; Nair et al. 2010; Stiess et al. 2009b), such as concerns over rising energy costs, environmental concerns, the desire to improve comfort, or particular opportunities to make energy efficiency investments. Drivers also include public policy measures that make energy renovations more popular in society (Cadima 2009).

Policy instruments have sought to overcome barriers and support drivers for renovations in Europe. In particular, the availability of grants for energy renovations or investments is mentioned in several studies as an important stimulus for energy investments (Huber et al. 2011). In some countries, grants are generous enough to make the investments more profitable, but there are studies indicating that grants can make an impact that is larger than their actual financial significance (Aalbers et al. 2009): Grant schemes can also influence the timing of investments and communicate to building owners the priorities of society. Similar impacts are expected from energy performance certificates (EPCs), which are intended to make the energy costs visible to new renters and purchasers of buildings, but can also due to their overall visibility increase awareness and discussion on energy issues. Many studies also mention the crucial role of public local advisory agencies or advice events as central stimuli for energy renovation decisions (Jager 2006; Cadima 2009; Stiess 2009b).

Our review of drivers aimed to inform an initial selection of decision criteria for energy renovations used in ENTRANZE Task 2.4, which is presented in Table 2.3.

Different studies have focused on different types of motivations. However, there is an overall agreement that **economic motives** are important (Huber et al. 2011, Cadima 2009; Stiess et al. 2009b). These often include expected savings on energy costs. Since initial costs are a concern for many building owners, low initial investments may stimulate the adoption of new energy solutions, and this is, for example, what several grant schemes have aimed to support. Low initial costs also decrease the perceived risks and make energy solutions “triable” (Rogers 1995), i.e., “not a life-or-death decision”. They can also facilitate the making of the renovation without the need to take out a loan (Stiess et al. 2009b). Financial criteria can also relate to simple payback periods or to more sophisticated analyses of return on investment. They can also include e.g. improvements to the value of the property and increased chance for renting the property (Huber et al. 2011), which is here discussed under “other benefits”. As energy performance certificates (EPCs) gain ground in Europe, they are expected to help building owners to verify and demonstrate the ensuing increase in the value of their property (Cadima 2009).

Ease of renovation has been stressed in several recent studies (Thomsen et al. 2009; Mlecnik et al. 2011). The role of quality service and e.g. advisory events is stressed in several studies (Huber et al. 2011). There is also a growing demand for renovation services involving quick installation and limited disruption, at least in some market segments. Successful deep energy renovations have been carried out when they are easily available and quality services are well packaged into “turnkey solutions” (Thomsen et al. 2009; Mlecnik et al. 2011). However, this may vary by market segment, as some might prefer to save money and do part of the work themselves (Stiess et al. 2009).

In Table 2.3, “**Lifetime and risk considerations**” refers to a category of issues pertaining to the timing and lifespan of the investment. Timing in general is often stressed as a critical factor in energy renovations. For example, Stuess et al. (2009) identified several social and technical “occasions” when energy renovations are considered: e.g. purchase of a new second-hand house, pre-retirement stage and technical need for renovations. On the other hand, recent (unamortized) investments into e.g. heating systems might make the owner reluctant to change; however, Nair et al. (2011) found that homeowners who had made renovations previously were more likely to make further renovation decisions. For more technical building components (such as heating or ventilation systems), ease of maintenance and use may also play a role. Moreover, there is some evidence indicating that perceived (and perhaps also real) risks are lower when renovation solutions are widely used (Jager 2006; Stuess et al. 2009b).

Other (than energy-related) benefits are generally viewed as important both for owners and, in particular, for building users (Huber et al. 2011; Stuess et al. 2009b; Cadima 2009). Improved comfort is often a more important driver for renovations than energy saving. Visible improvements can also include the value of the property (and indeed the entire neighbourhood) and can grant social approval or enhanced social status to the building owners or users – or conversely, e.g., reduce the social stigma related to social housing.

Environmental and societal motives and pressures are here grouped together. Environmental motives, concerns for resource conservation and a desire to be more energy self-sufficient can be internalized (non-financial) motives for some groups of building owners (Huber et al. 2011; Stuess et al. 2009b). However, the stimulus to consider environmental and energy issues in renovation decisions often derives from external factors, such as advisory agencies or public information. In particular, expectations of tighter regulations in the future and recommendations by experts have been found to encourage building owners to make energy improvements when renovating (Huber et al. 2011; Stuess et al. 2009b).

Table 2.3: Initial selection of decision criteria examined in ENTRANZE Task 2.4.⁴

Economic
Initial cost Payback time Return on investment
Ease of renovation
Quality service available Quick installation Turnkey solutions available
Lifetime and risk considerations
Timing vis-a-vis previous renovations Ease of maintenance Widely used solution
Other benefits
Improved comfort Social approval/status Improved value of property
Environmental/societal motives/pressures
Environmental considerations Expected future regulation Recommendation by experts

Source: Own compilation

⁴ Some of the items might fit better under another category (e.g. value of property is perhaps more naturally a financial criterion, widely used solutions perhaps relates to social or societal pressures).

Naturally, it is to be expected that different types of building owners and stakeholders have different decision profiles: most of the existing literature on decision making concerning renovations pertains to single-family owners. Moreover, there might be criteria not addressed here that are important for certain types of building owners or stakeholders. Furthermore, different criteria may be important in different countries, and there may be some criteria not listed here that are important in some countries. Hence, the current listing serves merely as a first step in the identification of decision criteria for energy renovations in ENTRANZE.

3 Data and methods

Task 2.4 of the ENTRANZE project has a total resource allocation of 841 person-hours, which amounts to about six months of work. This is not sufficient to conduct extensive original research into the situation and decision making of 12 different building owner and stakeholder groups in nine different countries (i.e., 108 different building type-owner combinations). Fortunately, much is also known on (a) barriers and drivers of energy renovations *in general*, as described above, and (b) barriers and drivers of *particular stakeholder groups in particular countries*.

Hence, the research conducted in Task 2.4 has focused on **identifying and filling in knowledge gaps**. This has been done through the following stages:

1. Identification of knowledge base and initial judgements of project partners on stakeholders and their key barriers and drivers. This has been done through a questionnaire to partners asking them to fill in their initial view of the roles of various stakeholders (Table 1 in Chapter 2) as well as of the 'critical' and 'contributory' barriers (Table 2 in Chapter 2) and decision criteria (Table 3 in Chapter 3, rated 1-5) for each building type-owner combination. Partners were also asked to provide suggestions for research literature and experts to interview in their country.
2. Refinement and redefinition of relevant owner categories for each country. This was done primarily on the basis of (a) the share of particular owner types in terms of total building area and (b) existence of information on distinct decision profiles for a particular owner type. As a result, some owner type categories were divided into several sub-categories and conversely, some were combined. Each country thus has a unique combination of "major building owner categories" that is specific to that country. Very small and heterogeneous owner groups are not discussed in detail.
3. A literature review to confirm or disconfirm and specify initial judgements of project partners. In addition to the literature review, an extensive review of available national and European statistics and statistics held by industry associations was conducted. The results of European framework projects and Intelligent Energy Europe projects were also examined and used. This review indicated that indeed, fairly much is known about certain stakeholders in certain countries, but **not** about each stakeholder in each country. The scope (and sometimes the quality) of existing data and literature was not always very satisfactory, either. Moreover, some things have changed quite significantly in recent years in many countries (not the least, in new member states), so some of the knowledge in the literature may be outdated⁵. Hence, the results of the literature review are indicative rather than conclusive.
4. Expert interviews to fill in the most important gaps. For each target country, 3-4 experts have been interviewed (mainly over the telephone) to fill in the most important data gaps and to gain the experts' views on each owner group's most important barriers and decision criteria in their country

⁵ Unfortunately, this situation was not limited to e.g. observations about building owners' investment behavior, but also extended to issues of 'fact' such as legal issues. We found several literature sources with conflicting information on e.g. available grants, required majorities for decision making in condominiums, etc. and our interviewees also offered us contradictory data on these issues.

(see Annex 1 for a list of experts interviewed). These expert interviews were used to (1) complement the qualitative data offered by the literature review and bring in new information on barriers and investor decision making and (2) to get a third, fourth etc. opinion (in addition to our own partners' and the literatures' views) on what are the "most important" barriers and decision criteria for each owner group. The types of experts selected for the interviews depended on the specific information needs for each particular country. They include policy makers, researchers, experienced practitioners, building owner associations and building owners.

5. The expert interviews offered a great deal of data and specific insight from each country, as well as a wealth of new issues to be considered (these are reported in each chapter) and many suggestions for how the situation could be improved. Unfortunately, many of the experts were not able to comment on all of the owner groups, as their experience was limited. Hence, we gained more and better viewpoints on e.g. single-family homes and owner-occupied apartment buildings in the countries where these are common forms of dwelling and tenure. The task of identifying "the most important" barriers and decision criteria also proved to be difficult, as there can be quite a wide variance within a certain owner group (for example, concerning the importance of environmental criteria or the role of initial costs in decisions). Hence, many of the experts were unwilling to offer any comments on some of the owner groups' most important barriers and decision criteria.
6. The expert interviews were documented, and analysed and used as follows: We considered the consistency of different experts' views (where available) and the degree of confidence that they expressed in their views. We tried to assess the evidence on which they drew their viewpoints, the logic of their judgement, and the extent to where they agreed or disagreed with each other and the literature. This forms the basis of our identification of what are deemed the "most important" barriers and decision criteria for each owner group in each country.

There are thus several limitations to the results of this study. There are limited expert interviews for each country, and often less than three opinions for each owner group. It would have been good to make more interviews than the 3-4 per country, and have several expert views focusing specifically on each owner type in each country. Also, the expert opinions gained through interviews are often based on a limited set of data or experience (at a certain period in time), and may not hence be completely representative. Issues of language and understanding were also sometimes a problem. Especially concerning public buildings, office buildings and e.g. private rental apartments, the results are indicative and would merit more research.

However, the results obtained are the best that could be achieved with limited time and budget, considering the broad scope expected from this study. We consider that they represent a more advanced view than the initial state of knowledge (where all potential barriers and all decision criteria are equal). In particular, we have tried to highlight **the particularities of the situation of different owner groups in different countries**, rather than drawing on preconceived theoretical viewpoints or highly general opinion surveys of the whole population.

4 Austria

4.1 General overview

In Austria, the number of dwellings was 3.6 million in 2009. Some 45 % are single-family houses, the rest are dwellings in apartment buildings. Approximately, 11 % are owner-occupied apartments, 40 % are rental apartments and the rest other forms of tenure. (Amann et al. 2012.) The average and the per capita sizes of apartments in Austria have risen. The average size of rental apartments is 67.5 m², the size of owner occupied apartments in multi-family buildings is on average 82.6 m² and the size of single-family houses is on average 120 m². The age structure of the building usually determines the energy efficiency: the energy demand varies between 305 kWh/m² for old buildings (built before 1900) to 15 kWh/m² for passive buildings (Lehr et al 2009.)

Austria's official Energy Strategy is influenced by EU-wide goals. Energy efficiency is to be improved at all stages of provision and energy use. 28 % of the final energy is used for space heating and cooling as well as water heating, mostly in private households. In the residential building sector, energy efficiency goals are to be reached by stipulations on the energy efficiency of new construction as well as by the introduction of Energy Performance Certificates in 2007 according to the Guideline 6, which is based on EU-law. In addition to the energy efficiency improvements of new construction, the increase of comprehensive thermal refurbishments and the enforcement of new heating systems will be strived for. The refurbishment rate of 1 % is supposed to be increased into 3 % by structuring of the regional housing subsidies. (Amann et al. 2012.)

According to Lehr et al. (2009), no significant improvement of the overall efficiency will be reached by 2020 with an average renovation rate of 1 %. Any building that has been built before 1980 and a share of the buildings built 1980-1991 is considered to be needing refurbishment. According to them, one per cent reduction in the building sector leads to 0.2 % reduction in overall final energy consumption and if the annual rate is increased to 3% and if changes of the heat and hot water system to modern standards are enforced, investments for such an efficiency improvement would require 1.4-1.7 billion euros per year.

Regarding public subsidies to the residential sector, the Austrian market is characterised by different federal, regional and private subsidy schemes. Unlike many other European countries, Austria co-finances a large part of any new construction partly out of housing subsidies, which are an indispensable part of financing for most builders. This is the case for private individuals as well as for social housing builders (Limited-Profit Housing Associations, LPHAs), commercial developers and municipalities. This explains the very high 80 % of housing starts that receive some kind of subsidy. Especially owner-occupied houses and LPHA-built owner-occupied apartments received large amounts of subsidies (Amann et al. 2012.)

Financing of energy efficiency improvement measures is generally based on three main financing types: financing by the user/consumer, public subsidies and commercial bank loan financing. Subsidies for energy efficiency improvement measures in non-residential buildings are administered by one body, but are also facilitated by a number of federal and regional information and advice programmes. Banks are offering special credit lines for energy efficiency measures. (Rezessy and Bertoldi 2010.)

The task to implement mandatory building standards is assigned to the regional governments in Austria. Regions therefore play an extraordinary role in improving also energy efficiency policy. (Schüle et al. 2011.) Previously to 2009, funding was organised through federal budget earmarked to housing policy measures. The nine regions in Austria spend 2.82 billion Euros on direct housing policy, which makes around one per cent of the GDP in 2009. 49 % of these expenses were directed to new multi-storey construction in the form of social housing, some 13 % were direct subsidies of individuals constructing single-family houses for themselves, 14 % were demand-side subsidies in the form of housing benefits and 24 % were direct refurbishment subsidies. (Amann et al. 2012.)

The regional subsidy schemes are presently tied to a minimum energy reduction. Most regions have also introduced increasing subsidies for increasing thermal quality of the buildings, and extra subsidy schemes or

direct grants for the use of renewable energy sources. In some regions, the granting of a subsidy is tied to the utilisation of energy advice in the planning phase of the new construction or renovation project. In most regions, energy certificates are compulsory when applying for state subsidies. In some regions, there are also subsidised rental apartments by commercial builders. (Amann et al. 2012, Rezessy and Bertoldi 2010.)

Subsidy schemes for renovation of old buildings differ depending on the part of country, the building type (apartment, single family house, multi-family building) and kind of renovation (small or total renovation). Mainly measures to improve energy efficiency, heating system or materials used in buildings are subsidised. There are several approaches used for subsidies: definition of minimum heat insulation standards, subsidy depending on achieved U-values, and subsidy scheme depending on total space heating energy system. (Streicher et al. 2004.)

Refurbishment measures received a voucher from the federal budget. The voucher was granted in form of a non-repayable grant of 20 % of eligible refurbishment expenses up to a limit of 5,000 € and was used mainly in the private single-family housing stock. The subsidy volume rose to 61 million euros and it motivated a total investment of 485 million euros or approximately 33,000 € per refurbishment. Thus, a relatively moderate subsidy functioned as a driver for larger and more expensive investments into retrofit of the building stock. (Schleicher and Karner 2010.) Still, thermal refurbishment is rather poorly implemented in all other housing sectors, except the LPHA buildings. Both the condominium sector and the big stock of single-family houses show only low refurbishment rates. (Amann et al. 2012.) However, the highest potential for sustainable refurbishment is within the sector of single-family houses, which were built between 1945 and 1980. Two-thirds of all possible investments are estimated to be assignable to this category of buildings. (Ornetzeder & Suschek-Berger 2008.)

As a complement to public subsidies, the umbrella organisation of oil retailers offers a subsidy for the modernisation of oil heating systems in residential buildings. Private persons can get a subsidy of 2000 €, which amounts to 20-50 % of the costs of a new condensing boiler. The subsidy campaign started in 2009 and is planned to run until 2016. The budget and the level of the subsidy are adjusted yearly. (Rezessy and Bertoldi 2010.)

Also commercial banks offer loans for energy refurbishment. Almost every large bank offers special credit lines for energy efficiency measures, mostly combined with information and advice activities such as online energy efficiency calculators, expert advice days in rural bank offices, vouchers or discounts for good energy certificates etc. There are also special interest rates for renovation projects in most of the banks and some banks also offer special credits with easier administrative procedures for smaller efficiency measures. All of these financing products can be combined with the state or federal subsidies. Most banks also include the identification and combination of state subsidies into their information and advice activities. (Rezessy and Bertoldi 2010.)

When considering the main social and demographic changes in the demand for social, co-operative and public housing in Austria, an important development can be observed: for the first time the number of households composed by only one person is more than 1 million, 33.6 % of the population. At the same time, the size of households has been decreasing: there was on average 2.4 inhabitants per household in 2003. The increase in households of singles and single parents is a general trend. These types of households are more exposed to insecurity and risk, due to fact that the household is sustained by only one income and if that is reduced or lost the existence of the household is in danger. Therefore, the availability of rental dwellings with affordable rents and with a significant level of security of tenure is particularly important for this type of households. (Bedir & Hasselaar 2008.)

Table 4.1 presents an overview of the owners and decision-makers by building type. The major building owner types are then presented in the next chapter. Major refers to categories that have a large share of the floor area and share distinct characteristics. For instance all rental social buildings are combined into one owner group regardless of the amount of the apartments in the building.

Table 4.1 Owners and decision-makers for residential, public and office buildings

Building and owner type	Share of total building area, % ³	Decision makers and type of owners ²
Single- or two-family homes		
Owner-occupied	37	Owner occupant
Rental	3,3	Landlord
Rental social	0,5	Community administration / cooperative (depends on the insitutional and organisational framework which is differs from case to case)
Others*	6,6	
3 to 10 apartment buildings		
Owner-occupied	2,8	Owner occupant
Rental	6,8	Landlord
Rental social	1,3	Community administration / cooperative (depends on the insitutional and organisational framework which is differs from case to case)
10 and more apartments		
Owner-occupied	3,12	General assembly of owners
Rental	8,2	Landlord
Rental social	3,7	Community administration / cooperative (depends on the insitutional and organisational framework which is differs from case to case)

Public buildings ¹		
State	0,5	BIG (Bundesimmobiliengesellschaft - Association for federal real estate (own translation), owned by the federal government)
Local government	3,5	Regional governments and communities
Region (ger. Land)	0,3	
Commercial office buildings		
Owner-occupied	13,9	owner or assembly of owners
Rental	7	Landlord
Other	1,48	
Total	100	

Sources: Statistics Austria 2001, Müller et al 2012 based on Statistics Austria 2010b, Statistics Austria 2009, Zoll 2010 ;

(1) Private schools, hospitals are not counted (Statistics Austria 2001)

* According to Statistics Austria, other ownership type can be an official residence, service buildings or other

4.2 Types of owners, stakeholders and decision-making structures

4.2.1. Owner-occupied single-and two-family houses

Owner-occupied single-and two-family houses, detached and attached, are the largest dwelling types in terms of floor space in Austria. The share of these types of dwellings from total floor space of all buildings is 37 %. The highest potential for sustainable refurbishment is considered to be in the sector of single-family houses, which were built between 1945 and 1980. Two-thirds of all possible investments are estimated to be assignable to this category of buildings. (Ornetzeder & Suschek-Berger 2008.) From detached homes 79 % are owner-occupied whereas among attached homes, 25 % are owner-occupied. Naturally, owners make the decisions concerning energy investments. Other parties, who can influence homeowners' decisions legally about energy investment, are the local or regional governments. The availability and quality of information has in general an influence on the investment decisions.

Energy efficiency investments are supported through a subsidy that the federal state has granted in form of a non-repayable voucher of 20 % of eligible refurbishment expenses up to a limit of 5,000 €. There were ca. 14 000 cases of grant receivers mainly in the private single-family housing stock. The nine Austrian regions also provided subsidies to small-scale refurbishment measures as well as to comprehensive thermal refurbishment of buildings. (Amann et al. 2012.)

The regional financial instruments vary a great deal: there are long term loans, annuity subsidies to capital market loans, grants, demand side housing benefits in case of increased user costs due to renovation works. In order to activate household capital reserve in the area of single-family houses, refurbishment subsidies are often designed as non-refundable grants rather than re-payable long-term loans. Only a small part of refurbishment subsidies are income-dependent and classified as demand-side, usually in the form of increased housing benefits after eligible renovation works. (Amann et al. 2012.)

According to Ornetzeder and Suschek-Berger (2008) in the private households in Austria refurbishment is still dominated by single-step procedures and a strategy that is oriented towards household finances. Also, the subsidy schemes are insufficient and there is urgency to carry out reparations promptly. In the countryside, the repairs are even done by the owner himself or in cooperation with semi-professional craftsmen. This is considered to considerably hinder the realisation of comprehensive and ecologically effective refurbishment. There are, however, promising new ways of promoting sustainable refurbishment. Innovation networks could stimulate the demand for energy efficiency refurbishments by improving the technical offer and closing the gap between the demand and supply. In the building industry, local networks try to develop comprehensive offers for homeowners, an innovative approach that offers a combination of advisory services, planning and new refurbishment technologies instead of only one product.

The network activities that were introduced in Austria aim to improve offers for private customers. Homeowners should get up-to-date information on ecological refurbishment to promote energy saving and maximise the ecological effect. The cooperation in these networks in the area of Vorarlberg and Tyrol should improve the technical know-how and practical skills of the involved companies and also to promote joint refurbishment projects. (Ornetzeder and Suschek-Berger 2008.)

The members of the Tyrolean network 'Ecomodel' are mainly from the local construction industry and their main motivation to join is the possibility to acquire new customers. Some members have left the network because their expectations regarding new customers have not been fulfilled although the outstanding consultation services. Obviously, consultation does not directly result in corresponding contracts and project realisation. The network includes also two banking institutions and some municipalities. A close analysis of the networks and their influence on true refurbishment project revealed that network activities alone are not enough. Changes are needed especially in the regulatory framework to increase the demand for sustainable refurbishment. (Ornetzeder and Suschek-Berger 2008.)

According to the Austrian policy group specialists, the demographic change raises new questions especially in case of owner-occupied single- and two-family houses. There are elderly people living in very large single family houses after their children have moved out. People tend have a strong emotional link with their homes, which reduces their willingness to move and especially in case of elderly change into a smaller apartment. Also, the emotional bond of home owners to their home poses an opportunity for building renovation, as people want to take care of their homes, but also a barrier in case of older owners who cannot for some reason start a major renovation. Thus, elder people have to be addressed separately. (Kranzl 2012.)

The main barriers to energy renovations can be summarized as follows:

- In case of owner occupied single and two-family dwellings the most critical barrier is posed by conflicting information and house owners' mistrust on information. Contributory barriers rise from heterogeneous outcomes and uncertainty concerning measurement and verification of energy saving. House owners cannot be certain about the outcome of the energy efficiency renovation process, which reduces the willingness to start a renovation. The private household's energy renovations are commonly step-by-step renovations, i.e. it is easier to finance one measure at a time. For more comprehensive renovations you need an overall concept to fit different technologies together and there are uncertainties about the final outcome.
- High initial cost and a long payback time are critical to home owners when considering about refurbishment. Financial subsidies help to remove these barriers but currently subsidies focus on new buildings. However, the emphasis should be shifted to renovations to increase the energy efficiency of the existing building stock. Another issue to consider is that there are a "jungle of incentives": municipal, regional and state level subsidies. This leads to single measures in renovation activities but not to a comprehensive renovation, which would be necessary. All subsidies, grants etc. should be bundled i.e. they should not be as spread around as they are currently and all renovation subsidies/grants should be linked to energy efficiency improvements. For private home-owners reducing initial costs would be important. People often are risk averse und therefore they are generally unwilling to incur debt although this depends also on income and age of the home owner. This is a critical barrier in energy efficiency renovation.
- One of our interviewed experts pointed out that one of the most critical barrier especially for owner-occupied single-family homes in Austria is that there are a lot of 'do it yourself' people at the countryside, who want to do everything by themselves and are reluctant to get any craftsmen working in their home, because they do not want to be dependent on any external people Thus, to remove this barrier there would be a need for sustainable "do it yourself" –technologies, especially in the countryside.
- Lack of customer attention and interest is a critical barrier in energy efficiency refurbishments in case of owner occupied single and two-family houses. Typical for this group of building owners is that they are older. Thus, there is a generation of older people, who have little incentive to start

renovation. Therefore, new generations present a possibility for energy improvements, but new generations also want to enlarge their house, to have more living space and to change the structure of the house.

- Lack of customer knowledge is also a critical barrier in energy efficiency refurbishments. Experts that were interviewed for this study state that there are prejudices of the small company builders and homeowners against isolation, because i.e. the 'house doesn't breath' afterwards. A suggestion would be working with tenants, involving and informing them and training the craftsmen. However, experts remind that only delivering more information is not enough to remove barriers. There should be show cases near people locally. They should be able to talk to home owners who have done a refurbishment to know about technical problems and to hear about experiences, like increased comfort or energy savings. Real home owners are the best and most reliable information source.
- There is lack of experienced and skilled craftsmen as well as lack of information of the inhabitants. According to one of the experts, homeowners in small cities or countryside do not trust the craftsmen and therefore do not want to engage them. Craftsmen are not always skilled enough and the negative reputation spreads around in the countryside and in the small towns (up to 10 000 inhabitants or even more) very easily. There should be much more education and training for the craftsmen, there should be much more effort to educate/train them and the training should go much deeper than currently.
- High information search costs, switching costs including concerns over disruption and risks of failures in renovation make out critical barriers to energy renovation.
- According to one of our interviewees one problem in Austria is that the homeowners that would especially need a renovation are very spread around and there is the question on how to reach these people. One solution to remove this barrier would be the creation of network of agencies i.e. one source where homeowners can find help and all information that they would need in any stage of the refurbishment. It should be organised by the local government or some other trusted source, where people can find information and advice to start planning a refurbishment. This "all in one - store" should be situated near the people, and there should be local firms, who are delivering the service. Establishing this would require regional networks of skilled workers, they should be experts that are able to do the renovation in a comprehensive way. There is a need of more complicated models to bring companies together. A formation of networks of companies should be promoted and more energy advice and training to craftsmen should be offered. These would help to gain a common understanding that energy refurbishment are necessary and also useful for people.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- Financial criteria are important in general for owner-occupied single and two-family dwelling owners. Initial cost is the most important criteria, because if people have the funds, they can invest it in in energy refurbishment, if they do not, then the reluctance of taking a loan hinders the renovation. Initial cost opens or closes the window of opportunity, if the house owner already has got the financial means to do the retrofit. The decision making for a complete renovation is comparable to building a new house. High initial cost actually means like the owner would be building a new building. Thus, it is a very important criterion. Therefore, the availability of subsidies plays an important role.
- A short payback time of investment is not important as a criterion, but it has some importance considering the satisfaction of the house owner with the finished refurbishment. People do not examine any monetary payback times, but they have a "feeling" of the payback time, which says basically whether or not the investment is useful or not.
- According to our interviewees, expected energy savings are somewhat important in non-monetary terms. People think that they gain something but it is not money. Energy prices are not high enough for expected energy savings to be important as criteria.

- Turnkey solutions available are important, because people want to be personally involved, but quick installation is important only in case of step-by-step renovation, otherwise not. Also, the ease of maintenance is important only for single measures. This “evolutionary renovation approach” is not efficient in delivering a good quality and effective energy refurbishment and it should not be encouraged.
- According to one of our interviewed expert, improved comfort is not important as a driver, because people do not even realize that energy retrofit would improve their living comfort.
- For some people, environmental considerations are very important, as they are linked to comfort, status, modernity, future oriented way of living, but the actual energy saving is not that important.
- Future energy prices are important, not so much expected future regulation.
- According to our interviewees recommendations by experts are not as important as criteria, but the recommendations of other people are, who actually have done refurbishment in their home and live in a renovated building. This means that show cases are important, where the taken measures are visible. Real life examples are much more convincing than expert recommendations.

4.2.2 Owner-occupied multi-family buildings

Owner-occupied multi-family buildings make up 8.5 % of the total building stock in terms of floor space (2.8 % + 5.7 % from the table above). The share of owner-occupied apartments in buildings with 10 or more apartments is 20 %. About two thirds of the dwellings in multi-family buildings are situated in buildings that were built after the Second World War (Streicher et al. 2004). The share of home-ownership in Austria increased constantly for the last 30 years and in 2008 it accounted for around 28 % of the total housing stock. The introduction of rental dwellings with the ‘option to buy’ -scheme is one of the major developments in Austria. The result of this scheme will be mixed tenure buildings. Providers express some concern about this option. From their experience, such a solution is considered to increase difficulties in the management of the building. This is because maintenance and energy upgrading have proved to be easier to implement in schemes with only or predominantly rental housing. (Bedir & Hasselaar 2008.)

The condominium law regulates how public parts of the building have to be administered by the association of owners. The majority of owners must approve the monthly payments to the maintenance reserve and the raising of a loan for renovation activities in the case that reserves are not sufficient to cover investment costs. Earlier it used to be that for any kind of improvement measures, i.e. investment that goes beyond the pure maintenance of building a unanimous decision of the owners was necessary. (Streicher et al. 2004.) Now, the decisions to improve or maintain jointly owned property are majority decision but there are still minority rules to take into account also the opinions of the minority (Hüttler et al. 2006).

In owner-occupied multi-family buildings the decision-making process is thus very different to a case with only single owner and the ownership structure makes the decision making difficult. For example, the roof, façade, outer windows, fire places, staircases belong to all owners collectively and therefore all costs related to these are joint and burden the owners according to their share of the whole building. The practice has shown, that not necessarily financial or technical issues are hampering investment processes but the missing acceptance or disagreement between the occupants. (Hüttler et al 2006.) Still, according to Bedir & Hasselaar (2008) considering energy efficient renovation, a participative decision-making method has potential for improving the quality of the design regardless of the problem that when decisions need a majority some suggestions will not be realised. However, technical solutions can be improved and the participative decision-making can increase inhabitants’ willingness to cooperate. It has the potential of realising the project at an earlier stage and can minimise the financial risk of the developer. A joint decision is likely to speed up the design and construction process, which is cost efficient. In addition, participative decision-making is a way to promote user friendly designs.

In the decision making of owner-occupied multi-family buildings the property management moderates the meetings and the decision process, but it is also an involved party and this makes the decision process very difficult. In the case of a neutral third party, consisting of a moderator and advice of experts, the

representatives of the property management institution can better concentrate on their substantial input and on replying to concrete questions. The gatherings of residents have shown that a professional third party moderation and consultation can considerably relieve the property management institution. (Hüttler et al. 2006.

It has been realised that if residents are well informed and are confronted with a transparent process design, the chance of realising a sustainable energy refurbishment increases. Comprehensive information and transparency can be achieved with methods, which enable an evaluation of the state of the art as well as an investigation of various possibilities including an estimation of expected costs. In Austria, a project 'The klima:aktiv program "wohnmodern"' has been launched, which offers a rough analysis for property management institutions and communities of residents. In addition, it includes the participation of independent experts at resident meetings who are to present the state of the art and the recommended measures of a comprehensive modernization to enable informed discussions.

This project is based on the idea that improving the planning, information and decision making processes the acceptance of complete and innovative renovation activities could be increased. To elaborate all complexity the project involves all owners prior to the renovation to plan the realisation of the needed retrofit. In a next step well organised and independent information will be delivered to the owners. Then a transparent, step-by-step decision making process is organised and moderated to reach acceptability as high as possible. Finally, the decision will be made upon the individual questions about the whole energy retrofit process, financial questions and the interests of the owners. (Hüttler et al. 2006.)

In big buildings with more than 100 owners or a mixed structure with a high share of rented apartments the communication and gaining a joint view is very hard through the unfavourable ownership structure. There are complaints that owners, who rent their apartment have less interest in maintaining the building in general and often do not even attend to meetings. Hüttler et al. (2006) have found out that the owner-owned apartments often are in not such a good shape than comparable rental multi-family buildings. A thermic renovation are realised much less in owner-occupied multi-family buildings than in rented multi-family buildings.

The main barriers to energy renovations can be summarized as follows:

- In case of owner-occupied multi-family buildings collective decision problems are high in the importance and they have influence in all other barriers. They thus pose a critical barrier to energy investments. According to one of our expert interviewees, when it comes to decision making, this group acts like companies that cannot make any decisions. These people are like single home owners and their barriers and motives are similar but they must act collectively. Thus, the single most important problem is the decision making. One solution might be changing the legal basis because it used to be that only one opponent was able to prevent any improvement process.
- According to our expert interviews, there should be legislation that forces to do energy renovation; otherwise nothing will happen in case of owner-occupied multi-families.
- The category genuine uncertainties regarding cost effectiveness is considered very critical altogether. Conflicting information, mistrust of information and heterogeneous outcomes are all critical barriers. Uncertainty concerning measurement and verification of energy saving are also critical barriers in case of owner-occupied multi-family buildings. The uncertainties gain a decisive role when the decision making has to be made collectively.
- High initial costs and long payback times are critical barriers when considering refurbishments in owner-occupied multi-family buildings. Here, the occupants are most likely small families or single persons and in their case financial questions have high importance. Access to or the cost of capital is a contributory barrier that depends on income or age of the occupant/s. Unwillingness to incur debt is also typical for these kinds of occupants and it also depends on income or age.
- Lack of information and skills are also critical barriers to energy refurbishment projects in case of owner-occupied multi-family buildings comparable to those of single family homes described above. Lack of customer attention and interest as well as lack of customer knowledge pose critical

barriers to energy efficiency refurbishments. The unsophisticated financial analysis pose a contributory barrier.

- High information search costs, switching costs due to concerns over disruption and risks of failures in renovation are considered also as critical barriers. Lack of skilled providers is a most critical barrier according to some of our interviewees.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- Low initial cost is an important driver for energy efficiency retrofit. One of our interviewed expert pointed out that initial cost is the single most important criterion, because if people have the funds, they can invest it in energy refurbishment, if they do not, then the reluctance of taking a loan stops the renovation altogether. Initial cost opens or closes the window of opportunity, if the house owner already has got the financial means to do the retrofit. The decision making for a complete renovation is comparable to building a new house. High initial cost actually means like the owner would be building a new building. Thus, it is a very important criterion. Therefore, the availability of subsidies plays an important role.
- Expected energy savings are important as drivers in a non-monetary form. People do not examine any monetary savings, but they have a “feeling” of the energy savings, which says basically whether or not the investment is useful or not.
- The quality of service available and the quick installation are important criteria in case of owner-occupied multi-family buildings. This is due the fact that refurbishment has an influence on the quality of life/living during the renovation and the sooner it is finished, the less discomfort, thus the better. The quality of service is important for these people, because they are living in the house usually a long period of time and have to live with the quality of the finished work. Thus they have a vested interest to keep the building in good shape. One of our interviewee even though that it is the most important criterion.
- Timing of previous renovation is an important criterion. There is only little interest or financial possibilities of the owners to start a renovation process again, if the previous has just been finished. These are usually old buildings, where something has to be done sooner than later. Thus, catching the right moment would be very important.
- Widely used solutions are important because the technology has been tested and the possible problems are well known. There are also spare parts easily available if the used technology is widely in use. Also the widely used solutions may already have lower maintenance costs; as the spare part prices are lower due to higher demand. The installation is more reliable because the craftsmen have usually already experience in installing equipment, etc. There is less risk involved in choosing a widely used solution.
- For owner occupied multi-family building owners the improved value of property is an important driver for retrofit. The higher the value of their asset, the higher is the possibility to gain profit in case the apartment needs to be sold.

4.2.3 Rental multi-family buildings

Rental multi-family buildings (commercial or co-operative) make up 15 % of the total floor space (6.8 % + 8.2 %). The share of rented single-family houses is 3.3 %. Of all multi-family buildings with 10 or more apartments the share of rental apartments is 53 %. Home-ownership in Austria has increased constantly over the last 30 years as a result the share of private rental housing of all floor areal decreased from 31 % to 19 %. In subsidised new construction, owner-occupation has been replaced by rental dwellings with an option to buy after a 10-years-period. The rents have been increasing after the abolition of the rent control, like also the share of short term contracts. These trends have produced a growing demand for public/social/co-operative housing. At present, 30 % of rent contracts are short term in the private sector. (Bedir & Hasselaar 2008.)

In Austria, tenants have a legal role in decisions about renovation plans: they must accept alterations in the house that affect the rent level or the lay-out. According to the Austrian rent law (Mietrechtsgesetz, MRG), the landlord of a multi-family building must use first the rent reserves from the previous ten years when financing an energy efficiency refurbishment. The reserves mean the remaining from rent revenues after subtracting all expenses for maintenance in the given time-span. If these reserves are not enough, he must use the expected rent reserves over the coming ten years. Finally, if both financing resources are not enough the landlord is allowed to apply for an increase in the rent. This application has to be approved by the so-called "Schlichtungsstelle", which is an administration for the settlement of disputes outside the court system. (Streicher et al. 2004.)

In rental apartment buildings with many owners, the decision-making process is different to a case with a single owner. A participative decision-making method has potential for improving the quality of the design and technical solutions considering energy efficient renovation. It can increase the willingness to cooperate at the side of the tenants. It has the potential of selling the project at an earlier stage and can minimise the financial risk of the developer. Also, it is likely to speed up the design and construction process, which is cost efficient. In addition, participative decision-making is a way to promote user friendly designs. Bedir & Hasselaar (2008) emphasise that in order to achieve good citizen participation in refurbishment procedure, a social contract to help tenants move out of their houses for the time of the refurbishment should be provided.

The main barriers to energy renovations can be summarized as follows:

- For the rental multi-family buildings, the financial barriers are critical. The most critical barriers are high initial costs and long payback times. Especially, when the buildings are owned by private people, subsidies are essential because funding the retrofit is an important question. Therefore, it is necessary to have subsidies. In Austria more than 50 % of tenants must agree on renovation work and they are obviously interested in the rising rents. Thus, succeeding in doing the renovation with low initial cost, it increases the willingness of the tenants to accept the renovation project, because the pressures to the rent increases are lower.
- According to one of our expert interviewee, high energy prices would be needed to improve the situation, as they would motivate people to do efficiency improvements.
- One of our interviewee compared these people to a company. It is easy for them to make decisions.
- One problem facing especially this group of building owners is that if the owner does not live in the building, he does not have any personal motive to take care of the building and its refurbishment.
- The refurbishment of these buildings are hindered by the landlord-tenant –problem. It means that the costs of energy efficiency improvement investments are carried by the owner but the cost reductions from more efficient use of energy benefit the tenant. The owner is not in general allowed to raise the rent so his willingness to engage in such investments is low. This is the case in countries, where heating is not included to the rent, like in Austria. Especially in case of commercially owned rental building the question is: are there savings to realize or profit to gain for the firm, if the used energy is paid by the tenant?
- The lack of customer attention and interest as well as the lack of customer knowledge make out critical barriers for energy efficiency improvements in case of rental multi-family buildings.
- Switching costs and concerns over disruption as well as risks of failures in renovation pose critical barriers in case of rental multi-family buildings. This is because it is necessary that people still are able to live in their apartments regardless of the refurbishment. In case of a large buildings, it is linked to very high costs if for example something goes wrong and it would be necessary to find provisional living arrangements to all tenants, not to think of the discomfort of it.
- Lack of skilled service providers is a critical barrier for starting an energy efficiency refurbishment.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- According to the interviewed experts, the attitudes towards refurbishment depends whether the owners themselves live in the building or not in case of rental apartment buildings.
- For rental apartment buildings an important criteria are the initial costs and short payback times even though some interviewees thought that short payback time is not important. But, as these people would usually have to take a loan to finance the retrofit, the short payback time for them would be a quite important criterion.
- The quality of service available and the quick installation are very important criteria also in case of rental multi-family buildings. For this owner type it is however linked to cost. The better the quality of the work, the fewer problems there will be later, thus less extra costs or effort.
- Some of our interviewees though that quick installation it is actually the most important criterion altogether, but one interviewee pointed out that quick installation is not important for a professional rental apartment building owners, because usually the renovations take their time and there are no possibility to do them faster. The more important criterion would be the quality of renovation combined with quick installation and the question whether a quick installation can guarantee a good quality work. The reason why some experts think that quick installation is so important is that in Austria 50 % of the tenants in a building must accept the realisation of the retrofit. If it can be done fast it is an important driver to start the process.
- Timing vis-a-vis previous renovations is an important criterion because for rental apartment buildings the renovation is a life time question, the renovations follow planned phases individually set for each building. The ease of maintenance and widely used solutions are also important drivers.
- Improved value of property is very important, because the building is used as an investment and should produce profit for the owner. The better the quality and value of the property, the easier it is to find tenants and to require higher rents and also the resale value of the real estate is higher.

4.2.4 Rental social housing

Rental social housing forms a share of 5.5 % of the total floor space and 22 % of all dwellings. The amount of social dwellings is about 10 % above the EU-15 average. (Amann et al. 2012.) The Austrian social housing stock is managed by municipalities and Limited-Profit Housing Associations (LPHAs). There are strong regional and local differences in the division of Austrian housing stock. In the capital Vienna, almost 40 % of the housing stock is social rented dwellings. Social rental dwellings represent a predominant share of all dwellings in multi-family buildings and in the rental building stock in all regions. (Mundt and Amann, 2010.) Social housing is typically fully owned by the public sector but there is an increasing trend towards private involvement (Economidou et al.2011).

More than 95 % of the LPHA stock is in multi-storey buildings. (Amann et al. 2012.) In 2005, not-for-profit housing stock included 490,000 dwellings for rent and 240,000 owner-occupied dwellings (Bedir & Hasselaar 2008). In 2009, there were 99 co-operatives and 92 limited-profit companies, set up either as private limited or as joint-stock companies. Co-operatives are owned jointly by their members while the limited-profit companies are owned by local or regional public bodies, charity or religious organisations, trade unions, political parties, the financial sector or private persons. Apart from the ownership structures, there are only minor differences in legal status, because all LPHA activity is governed by the Limited-Profit Housing Act and supplementary by-laws. In international comparisons, the Austrian LPHA's are rather large, with an average over 4000 managed dwellings per provider. (Amann et al. 2012.)

In Austria, there are income limits for tenants for LPHA apartments. The income limit varies according to household composition and part of the country. In general, the limits are very high in international comparison and they are only checked when moving in. Future income developments are not taken into account. (Amann et al. 2012.) This means that social housing is available for relatively many people.

The Limited-Profit Housing Act is considered to be very favourable towards refurbishments. Expenses for refurbishment measures are collected within the cost-rent scheme as a mark-up on cost-rents on a long-

term basis: in addition to the cost-rents and maintenance fees for running expenses, social housing renters are charged the so-called “Erhaltungs- und Verbesserungsbeitrag (EVB), which is a fee for periodic renovations or improvement works. (Amann et al. 2012.) The fee is estate-based and varies according to the building’s age. If the collected funds do not suffice for comprehensive refurbishment and if the need for these measures is confirmed by a court decision, the legal framework opens the possibility to collect an increased EVB (EVB II) for a limited period of time. The energy costs saved through these refurbishment measures can be then included in the running maintenance fees charged to the renters for a limited period of 10 years.

According to Amann (2012), the LPHA sector is strongly committed to high standards in refurbishment, for one because it has access to comprehensive financing scheme that allows for regular and quite ambitious refurbishment measures. Second, legal regulations fit well to practical needs of refurbishment considering asset management, funding and enforcement. Further, the LPHA sector acts similarly as investor, developer and housing manager. Therefore, a long-term perspective in asset management takes place. Investment decisions in new construction and refurbishment are taken primarily considering retention of property value, smooth maintenance and social sustainability.

LPHA housing maintenance is better funded than all other sectors of the housing stock. Neither the private rental nor the owner-occupied sectors have similar financial and legal tools to enforce energy efficiency measures. Still, the LPHA sector suffers from rising construction costs and budgetary constraints, which makes it doubtful whether the hitherto achievements may continue. The achievements in the LPHA sector are a result of an integrated housing policy approach. Austrian social housing not only targets social policy issues, but also economic, environmental and regional development policy issues. (Amann et al. 2012.)

In general, the social housing sector has the highest renovation rates (and best thermal quality standards of new buildings and renovation). The barriers in this sector are significantly lower than in other sectors. The public authorities support these kinds of buildings so the financial questions or problems in decision making are not as relevant. The LPHAs also have access to information and skilled advice and therefore the energy efficiency refurbishment meet only a few critical barriers.

The main barriers to energy renovations can be summarized as follows:

- According to one of our interviewee, rent increases are difficult in case of rental social housing, because the rent rise must be decided in a court BEFORE the renovation. There must be an agreement beforehand whether the tenants will accept the raised rent and only then the companies can start the renovation process. In general, all subsidised buildings go to court, whether the rent can be raised or no.
- In Vienna, large part of the social rental multi-family buildings are connected to district heating, which doesn’t fit to the concept of nearly zero energy buildings. i.e. existing energy infrastructure prevents renovation. This is thus a barrier for a good quality, complete refurbishment projects; only some parts of the building can be modernized from economic perspective, changing the whole heating system would not make any economic sense. Also, the pricing of district heating is a barrier for i.e. insulation, because there are large fixed costs and low variable costs, thus there is only a minor possibility to save money through efficiency improvements.
- Financial issues are also critical barriers for these building owner types. In case of non-profit organisations, they have only a certain amount of possibilities to do renovations, i.e. a limited amount of buildings per year that can be renovated (maybe 2-3 in a year). To do more would mean more administrative effort, thus: more employed people. These organisations have good connections to public money and have good possibilities to get subsidies. It would therefore be easy to influence what they do, if the subsidies would be tied to energy efficiency improvements
- According to one of our expert interviewee, high energy prices would be needed to improve the situation, as they would motivate also the owners of the social rental building stock to do efficiency improvements.
- Lacked of skilled service providers is also here a critical barrier.

- Also switching costs and concerns over disruption as well as risks of failures in renovation pose the critical barriers in case of rented social multi-family buildings. It is quite natural that concerns over disruptions or risks of failures are critical in case of big apartment buildings with a lot of tenants. The tenants still must be able to live in their apartments regardless of the refurbishment. It is linked to very high costs if there is a failure in the refurbishment and it would be i.e. necessary to find provisional living arrangements to all tenants, not to think of the discomfort of it.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- According to one of our expert interviewees in case of social housing, the renovation of these buildings is “branding for the company”. The social companies have an exemplary role: to show people that even though the energy efficiency retrofit meets problems, it can be done. Further, energy efficiency is obligatory for new buildings. They must meet certain standards. They have therefore a show case –influence. This could also be the case for older refurbished buildings. These companies are actors for energy policy and the owners have knowledge how to influence policy. Thus, energy renovations fit to their company policy and therefore these social housing companies could act as forerunners for energy efficiency. Social housing and public buildings have many similarities, they both feel that they have public responsibility and they are motivated by the visibility.
- For these buildings, the quick installation and the timing vis-a-vis previous renovations are the most important as drivers.
- According to some interviewees the social approval or status are important criteria, but not all experts agreed. The same applies for future regulations. One expert expressed it so: “expected future regulations are not important to anyone, because they are too uncertain, decision makers direct themselves according to present regulations”.

4.2.5 State- and municipally owned public buildings:

State- and municipally owned public buildings: the share of the floor area of public buildings is only 4.3 % in Austria. Most of these are buildings of local governments 60 %, 12 % belong to the state, 5 % to the regional governments and the rest 23 % are other public institutions except for private schools or hospitals. In 2005, the municipal housing stock was 350,000 dwellings (Bedir & Hasselaar 2008) and it mainly belongs to the municipality of Vienna with ca. 220,000 dwellings (Amann et al.2012).

Energy Saving Performance Contracting for federally owned public buildings in Austria is an example of a very successful program where several strategies for the management of barriers were effectively adopted. It is an agreement between the owner of the building and the energy service company that guarantees a specified saving of energy. The contractor (i.e. the service company) finances, installs and maintains activities to reduce the energy consumption of the building. The contractor is paid according to the energy that he provides and it equals the energy savings which result from the new contract. After the contract ends the customer owns the renewed equipment and the benefits of further savings. The Energy Performance contracting is considered to be an extremely effective way to reduce energy use and costs, renew facilities and building systems without expending capital funds. Currently, numerous Austrian schools, ministries, barracks and universities have a contractor who will be informed in case of emergencies. (Tisch & Kaltenegger 2008.)

The contract runs over a period of 10 years and it is based on a model contract developed by the Austrian Energy Agency. The ways in which the occupants can influence the decisions of the contractor where to invest in a building, are fixed in a contract. This helps to overcome barriers like the fear of low temperatures or the fear to be at the mercy of the contractor. Based on the experiences of this program, Tisch and Kaltenegger (2008) conclude that ...“it seems that in the field of energy contracting the core problem is not the long-term bond to the contractor but the bond to a contractor who is not competent

enough and the absence of possibilities for the occupants of the building to take part in the decisions of the contractor.”

There are two hindering factors why the Product-Service-System was not used: for one, tendering procedure was feared to be too long and complex, and second, there was a lack of external assistance. Both of these barriers can be overcome with the help of a trusted independent third party. In Austria, the Ministry of Deployment and Economy with special emissaries for energy has assumed the role of the from both sides trusted independent party that informs, motivates, supports and acts as intermediary. This seems to be the crucial success factor of energy renovations in the federally owned public buildings in Austria. (Tisch and Kaltenegger 2008.)

In March 2001, The Federal Contracting Initiative for public buildings was launched, following pilot projects in 64 federal schools. By 2010, around 400 buildings (schools, administration buildings, ministries, law courts, prisons, parks, etc.) have been modernised with Energy Performance Contracting tenders, with an estimated average of the guaranteed savings of around 20 %. The total amount of annual savings has been approximated to be around 3.5 million Euro of energy costs. For 2010 tenders for additional 92 buildings were in preparation. This programme has been a major driver for the Energy performance contracting market in Austria. (Rezessy and Bertoldi 2010.)

According to Rezessy and Bertoldi (2010) Kommunalkredit Public Consulting GmbH administers public subsidies for energy efficiency improvements in non-residential buildings. It is a firm designing and delivering services for the Austrian public administration. Kommunalkredit provides different types of grants and they have a public/private hybrid nature, a national coverage and they address enterprises and public bodies, with an upper threshold of 200,000 Euro and 30 % of total environmentally relevant investment costs (lower thresholds ranging from 5,000-35,000 Euro). These grants finance and cover almost all small and medium scale technologies available on the market. Most of the grants are subsidies of up to 30 % of total environmentally relevant investment costs.

Energy investment decisions in case of the federal state are made by BIG (Bundesimmobiliengesellschaft - Association for federal real estate), owned by the federal state. In case of public buildings owned by local governments, decisions are made by regional governments and communities. There are no legal possibilities to transfer investments into rent. Decisions concerning state owned public buildings can be legally influenced by the Ministry of Economics, Family and Youth of the federal government. In case of local governments, decisions can be legally influenced by regional governments and communities. Decisions concerning regional and other public buildings can be legally influenced mainly by regional governments through building codes. In all cases, decisions can be financially influenced by federal, regional or local governments through financial support, taxation etc. Though information, the decisions can be influenced by (regional) energy agencies, architects, heating system installers, (and to a smaller extent chimney sweepers).

Focal point of the energy efficiency activities is the public building sector because of its exemplary role. Due to their proximity to end consumers, community buildings can serve as a model for citizens. Egger and Öhlinger (2009) list what has been reached so far for (office) buildings owned by the regional administration in Austria:

- annual benchmarking and monitoring for all buildings:
 - energy consumption per m² (heating & hot water) decreased by 18.5 % since 1994
 - electricity consumption has been stable despite of “more IT”
- a large number of low energy public buildings in Upper Austrian municipalities
- since 2003 TPF-projects for the public buildings are being implemented. The recent TPF project includes 10 school & administration buildings, over 600,000 € were invested and annually 58,200 € energy costs and 278 t CO₂ are saved. (Egger and Öhlinger 2009.)

They also suggest as most important measures for public buildings:

- minimum energy performance requirements for all new and renovated public buildings: public buildings (office buildings, schools, kindergartens)
- legal obligation for renewable energy sources for heating and hot water supply
- energy performance requirements in tender documents: a list of energy related criteria to be fulfilled by architects and planners is included in tender procedures
- legal obligation for energy accounting for municipalities: energy consumption can be monitored, targeted measures be developed and the results of their implementation be documented
- legal obligation to display the energy performance certificate of public buildings well visible for the general public. (Egger and Öhlinger 2009.)

The main barriers to energy renovations can be summarized as follows:

- According to one of our interviewee, major barriers for the refurbishment of public buildings in Austria pose personal friendships or relative relationships between the municipal/town decision makers and firms/craftsmen/architects doing renovations. These relationships determine who does the renovation. If the renovation firm/craftsman is not well informed or well skilled to do a comprehensive energy investment, the window of opportunity is lost and the renovation will be done inefficiently or the energy issues will be ignored completely. These friendships are impossible or at least very hard to avoid, so the solution would be to focus on education and training the local architects/craftsmen.
- A high initial cost of investment and long payback times pose critical barriers to refurbishment. The public sector is strictly managed through the yearly budgets. The budgets have limits and they cannot be exceeded.
- In case of local governments, the problems of collective decision making pose a critical barrier.
- High information search costs and switching costs pose critical barriers because the public funds should be used the most efficient way. Concerns over disruption as well as risks of failures in renovation pose critical barriers. In case of public buildings, they usually serve as places where people are helped or served and this service function is one of the core duties of the society. Therefore, any possible disruptions in fulfilling this duty must be seen as a serious problem.
- Also here, lack of skilled service providers is a critical barrier.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- Initial cost is important, because there are budget limits. Also, the authorities have to justify their use of money and they do not want to make oversized investments. The experts, however, did not have the same opinion about the importance of the initial cost. They evaluated the short payback time as more important.
- Public responsibility and visibility are important; the authorities have the role as being good examples and showing the road.
- There is a special barrier concerning local public buildings in Austria: most representatives are proud of their buildings and do not want to change anything in them. In Austria, local public buildings are often old and historic and the representatives want to keep them as they are.
- Quick installation plays a large role in the investment decision because the public buildings must maintain their functioning regardless of renovation.
- Timing considering previous renovations is a very important factor. It would not be economically very wise to make two different renovations within a short time but to combine them i.e. at the end of the life time of some components that have to be renewed. The experts agree that widely used solutions are important criteria. The reasons are the same as for other owner types.
- Social approval or status is seen as an important criteria by one interviewee. According to him the renovation of these buildings is “branding” for the authority. The public authority have an

exemplary role: to show people that even though the energy efficiency retrofit meets problems, it can be done. The public authorities are responsible for the realisation of the energy policy. Thus, they have public responsibility and they are motivated by their visibility.

4.2.6 Office buildings

Office buildings amount to about 14 % of the total building stock in terms of floor area. The large part, 65 %, of commercial office buildings is owner-occupied. The rest 35 % are rental office buildings. Therefore, the investment decisions in energy efficiency in office buildings are mainly made by the owners or the assembly of owners; in rental office buildings by landlord. The landlords in general do not have the right to transfer investments into rent. In some exceptional cases this might be possible and even then only through a quite complicated legal proceeding without any clear outcome. In case of collective decisions, a majority of more than 50 % of owners is needed that agree. The percentage will be calculated according to their share of the building.

Legally, decisions can be influenced by regional governments through building codes for office buildings. Financially, decisions can be influenced by federal, regional or local governments through financial support, taxation etc. Decisions can be influenced through information in case of owner-occupied office buildings by facility management and in case of rental office buildings by associations or chamber of economics. Office buildings are most likely the group that is the most similar between the European countries.

The main barriers to energy renovations can be summarized as follows:

- Conflicting information and mistrust of information pose a critical barrier in case of owner-occupied office buildings.
- Uncertainty concerning measurement and verification of energy saving is also a critical barrier for office buildings and therefore there must be reliable information about the energy use of the building. In case of office buildings, in Austria the bigger problem than heating is the cooling in the summer. For offices as working environments important issues are room temperature and climate, fresh air and the overall quality of working environment. Thus, in the renovations, the focus is not on energy issues.
- For office buildings, financial issues are most important because companies think in economic terms. High initial costs and long payback times are critical barriers in both rental and owner-occupied office buildings, because the owners naturally want to have value for their money. The access or cost of capital and unwillingness to incur debt are contributory barriers.
- In case of rental office building the landlord-tenant dilemma makes out a critical barrier. In case of owner-occupied office building, the short lifetime of decision e.g. due to short occupancy is a critical barrier. Collective decision problems are contributory barriers in both cases.
- The lifetime of the building offers windows of opportunities. In case of office buildings, there is no step by step problem: the firms usually renovate in comprehensive way. Companies use analysis where they measure and compare whether to renovate an old building or to decide for demolition and build a new one, also to enlarge the building.
- Lack of customer attention and interest make out critical barriers in both rental and owner-occupied office buildings. Lack of customer knowledge is considered more critical to the owner-occupied office buildings and contributory to rental office buildings. But there are possibilities to make building owners more interested, because the quality/ competition in the markets plays more role. The firms start focus more on renovation, because of competitiveness of their firm.
- Switching costs, concerns over disruption and risks of failures in renovation also here play an important role. They pose critical barriers for both owner types. The high information search costs pose a critical barrier for both cases of office buildings.
- The lack of skilled service providers poses a critical barrier. There should be good quality planning instruments and expertise to help firms save old structures. Architects should be trained so that

they could see the challenges of retrofitting existing buildings as they usually like to plan and build new buildings.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- Financial criteria are in general the most important. This is the case irrespective the owner occupies the office himself or the building is rented. Most important financial criteria is the initial cost. For the owner occupants short payback time has more weight than for rental office building owners. Return on investment is not as decisive criteria for a rental office building owner but it also depends on to which extent the owner can increase the rent or make some profit of the renovation. So, it is also a policy driven factor.
- Quick installation is crucial especially for rental office building owners but according to one of our interviewees if companies own their buildings, they are not in a hurry.
- For office buildings, the timing of the renovation is very important, so that it can be made in connection with other renewals that might be caused through an end of life time of some components etc. Important criterion is also engaging widely used solutions, because this reduces the risk of not functioning or unsuccessful refurbishment. There are more qualified professionals to repair possible future problems and better availability of replacement components.
- The improved value of property plays an important role in the decision making about possible energy efficiency refurbishment. For owner occupied office buildings also the improved social approval or status has significance as a criterion.

4.3 Discussion on barriers and drivers of energy renovations

Energy renovation is a process in which a multitude of factors influence the investment decision simultaneously. In the Austrian context one of our interviewees stated that “to reach an efficiency improvement that is sustainable and cost efficient, all elements must be available on a regional context and they have to fit together, not as a step by step support programme, but as a comprehensive policy programme with enough financial support and skilled people to realise initiatives in local context”.

The improved housing efficiency can only be pursued by a policy mix of support measures, regulatory measures, and incentives from tenancy law. Support measures have to exceed the existing measures. In a nut shell, the main problems with existing programs according to Lehr et al. (2009) are acceptance, information deficits and unattractive by-conditions. Further, the diversity of programs and regulations across the Austrian states proves as a barrier for larger companies because the information costs are rather high. Tenancy law could provide incentives to improve the efficiency of buildings if rent ceiling were including heating costs (Lehr et al. 2009.)

Like one of our interviewees stated: “it would be important to work with tenants, involving and informing them”. However, only delivering more information is not enough. New networks of good builders/craftsmen should be built and a trained energy expert should always be involved in the renovation planning/process. Competencies of the renovation craftsmen should be increased through education and enabling them to gain more experience. In addition, renovation subsidies should be linked with energy efficiency and energy certificates. In case of public buildings and social housing a public display of energy performance would stimulate energy refurbishments.

The Austrian example of “Energy Regions” has shown that “... guiding visions from regional level can ‘translate’ broader and rather abstract visions of sustainable energy futures into more concrete agendas reflecting the specific requirements and opportunities of a particular regional context”. (Späth and Rohrer 2010.) Another example shows also that regional initiatives can be efficient in realising energy savings: the regional energy agency (Energiesparverband) in Upper Austria has been implementing a multi-pillar strategy to transform the building sector and create an energy efficiency market since 1993. The

strategy focuses on actors and aims to change mind-sets, behaviour and investment strategies. In order to achieve this goal, it combines legal requirements with attractive financial incentives, professional training as well as information and advice measures. The result of the programme is that more than 74,000 new and refurbished buildings meet the requirements by 2007, which has led to energy savings of 350 million kWh/year. An evaluation showed that the implemented measures were very cost-effective, with every kWh saved costing only 1.8 Eurocent. Furthermore, several hundred passive houses were built due to the programme in recent years. (Egger And Öhlinger 2009;Schüle et al. 2011.)

The experts of the ENTRANZE policy group in Austria have recognised general barriers to energy efficiency refurbishments. One problem is that in Austria a common policy target is missing. Some major groups in policy making are not committed to CO₂-reductions in building stock and therefore the target of nZEB has not been pushed efficiently. There is also a tendency to individualised decision making, which does not take into account the impacts on other parts of society. Thus, a holistic view in policy making is missing. (Kranzl 2012.)

In general it can be stated, that financial subsidies help to remove important barriers but also reducing initial costs would be important. There are also informational barriers: people are focused rather on the investment costs but not on the life cycle cost analysis. Also, according to the policy group specialists (Kranzl 2012), there are a lot of people involved in the discussion process that have ideas but not the necessary in depth knowledge, which makes the decision making more difficult. There is also lack of quality of renovation measures. The know-how is a problem but talking about this gap is a taboo in Austria.

The move into nZEB calls for major changes in the structure of the construction sector. Until now, the construction sector has a tendency to focus on new buildings construction. What is needed, however, is the restructuring of the construction sector towards renovation. This would influence project management, know-how, other type of hard ware etc. Thus, the specialists of the policy group (Kranzl 2012) also call for change management.

In the following the barriers and drivers of energy renovations are summarised. There are some issues that our research has revealed.

- Financial barriers form the most important barriers for most owner types. In Austria a lot of attention has been paid to help overcome this barrier. The state and regional authorities offer a number of refurbishment subsidies for households although the experts have suggested that the subsidies system should be renewed. In spite of subsidies, the high initial costs and long payback times are critical barriers for most owner types. There are groups among home-owners for which access to or cost of capital a critical barrier. In particular these are the low-income and over 65 years aged persons among the "owner-occupied single or two-family homes".
- Other very important barriers are the transaction costs. Switching costs and concerns over disruption and risks of failures in renovation form critical barriers to all owners.
- The worry about occupant take-back (i.e. tenants will increase comfort level and no savings will accrue) is not a barrier to energy refurbishment in Austria. This is because the tenant has to pay for the used energy himself. The landlords make the decision about refurbishment not based on energy savings but due to altogether other motives.
- Low or uncertain resale value of property is also no barrier, because in general energy efficiency improvements are considered to increase the value of property. Even if the increase in value is uncertain, it is not the motivation why the refurbishment has been started, and therefore the uncertainty in this respect does not play any role. Lack of reliable advice is not a critical barrier to energy retrofit because reliable advice exists, but people are not always aware of it or are not interested enough to look for it but it can be a contributory barrier if reliable good quality advice is not available easily and locally, as the interviewees have pointed out.
- Unsophisticated financial analysis pose also a contributory barrier, for owner-occupied multi-family buildings even a critical one.
- Access to and cost of capital is also a contributory barrier to almost all owners as well as the unwillingness to incur debt.

Other insights from our study are:

- The most difficult group of owners are the one that live in their own apartments in multi-family buildings. These people face the barriers that are considered as critical. As this group also forms 16 % of all buildings measured by the floor area, much focus should be directed to removing the barriers that they are subject to. They face genuine uncertainties regarding cost effectiveness, lack of information and skills, transaction costs and financial barriers, which are made more critical though the collective decision problems.
- The energy refurbishments face also the most barriers among the owner-occupied office buildings. Among barriers concerning initial costs and payback times they are faced with transaction costs and lack of information and skills. Their specific barrier is the short time-frame of decisions, which is due to short expected occupancy.
- The third group with the most barriers is also a group living in their own real estate: the owner-occupied single- and two-family homes. They also are faced with transaction costs and lack of information and skills. A special barrier to them is their unwillingness to incur debt.
- The least barriers face rental social housing.

Generally it can be concluded that our study of Austria has revealed that alongside financial barriers, the most critical barriers are the transaction costs and lack of information and skills.

Table 4.2. Most important barriers to energy renovation for the different owner groups

AUSTRIA	owner-occupied single- and two-family homes	owner-occupied multi-family buildings	rental homes in multi-family buildings	rental social multi-family buildings	local governments public buildings	rental office buildings	owner-occupied office buildings
Genuine uncertainties regarding cost effectiveness							
Conflicting information, mistrust of information							
Heterogeneous outcomes							
Uncertainty concerning measurement and verification of energy saving							
Financial barriers							
High initial costs							
Long payback time							
Access to/cost of capital							
Unwillingness to incur debt							
Occupant take-back (i.e., tenants will increase comfort level and no savings will accrue)							
Low/uncertain resale value of property							
Organizational problems							
Landlord-tenant dilemma							
Collective decision problems							
Short timeframe of decisions (e.g. due to short expected							
Public budgeting practices							
Lack of information and skills							
Lack of customer attention and interest							
Lack of customer knowledge							
Lack of reliable advice							
Unsophisticated financial analysis							
Transaction costs							
Lack of skilled service providers							
High information search costs							
Switching costs, concerns over disruption							
Risks of failures in renovation							

Source: review and interviews as reported above

A closer look at the most important decision criteria for different owner groups shows that the single most important decision criteria for all owner groups is the **timing vis-à-vis previous renovations**. This means that policy programmes should be planned in such a way that the “windows of opportunity” could be reached in an efficient way.

For most owners also quick installation, widely used solutions and initial cost are important criteria. These are linked together: if the installation is quick, the work of the craftsmen does not cost so much, and if the solution is widely used, the craftsmen have already experience and the installation is quick.

Expected future regulations is not important, because they are too uncertain, principally decision makers direct themselves according to *present* regulations. Environmental considerations is also not important as a decisive motivation to start a retrofit. Return on investment is also not important, because it is too uncertain and people use unsophisticated “rule of thumbs” instead of exact calculations of return on investments.

Table 4.3. Most important decision criteria for the different owner groups

Criteria	Owner-occupied single- and two-family homes	Owner-occupied multi-family buildings	Rental multi-family buildings	Social rental multi-family buildings	Public buildings	Owner-occupied office buildings
Financial						
Initial cost						
Expected energy savings						
Payback time						
Return on investment						
Ease of renovation						
Quality service available						
Quick installation						
Turnkey solutions available						
Lifetime and risk considerations						
Timing vis-a-vis previous renovations						
Ease of maintenance						
Widely used solution						
Other benefits						
Improved comfort						
Improved value of property						
Social approval/status						
Environmental/societal motives/pressures						
Environmental considerations						
Expected future regulation						
Recommendation by experts						

Source: review and interviews as reported above

5 Bulgaria

5.1 General overview

The housing stock in Bulgaria is comparatively new: about half of it was constructed during the last 40 years and only 4% was built before 1919. However, it is not in good condition and is constantly degrading, mainly due to insufficient maintenance and inadequate management (UNDP 2007).

There is now a widespread recognition in Bulgaria that the process of deterioration of the housing stock must be stopped. The government has over the last few years taken a number of steps to address the problem, including: 1) adoption of a National Housing Strategy and a National Program for the Renovation of Residential Buildings (NPRRB); 2) adoption of an Energy Efficiency Act and establishment of an Energy Efficiency Fund; 3) adoption of a set of technical standards and energy efficiency norms; 4) ongoing preparation of enabling legislative measures 5) inclusion of an Action 1.2 Housing in the Regional Development Operational Program (RDOP).(UNDP 2007).

Practically all the housing stock is considered to need renovation, except for the newest buildings, because it does not meet present-day technical standards and energy consumption requirements (UNDP 2007). Nevertheless, the national strategic documents prioritize the industrially constructed residential buildings built in the period 1960 – 1990. Since 2005, energy standards for new and refurbished buildings have been significantly tightened (Todorova 2008). The newest norms are from 2009 and currently the new amendments of the Energy Efficiency Acts are under discussions in the Bulgarian Parliament for the transposition of the EPBD Recast directive and are to be adopted in September 2012.

Practical measures to promote energy renovation include (Kostadinov 2009; Rezessy and Bertoldi 2010; Trainrebuild 2011):

- Under the National Strategy for financing the building insulation for energy efficiency (2006-2020) the state grants a subsidy for measure implementation, audits and certification to state owned buildings, municipal owned buildings and private multi-family residential panel buildings.
- The National Programme for the Renovation of Residential Buildings (2006-2020) has multi-family panel buildings as a priority. The state supports the panel dwelling owners by means of direct subsidy of 20% from the renovation total.
- The Bulgarian Energy Efficiency Fund (BEEF) provides loans, partial credit guarantees as well as portfolio guarantees for ESCOs and for the residential sector. This instrument aims to provide an ESCO-type finance solution for multi-family buildings.
- The Residential Energy Efficiency Credit Line (REECL) was developed by the EBRD and the EC and offers loans for renovations, as well as an incentive depending on the energy savings achieved.
- A requirement of buildings with more than 1000 m² of space to undergo an energy audit. This was applied to public buildings and the thresholds are to be strengthened gradually to 500 m² from 2013 and to 250 m² from 2015.
- Renovation under Operational Programme “Regional Development” – EU grants up to 85% are provided for energy renovation of municipal and state buildings and up to 50% for multifamily residential buildings. The cost of energy audit and project management are also included into the scheme in order to facilitate the process. Several banks are involved in order to ensure pre-financing and financing of the own contribution of the flat owners. This new scheme aims to remove the main obstacles for owners of multi-family residential buildings.

During the past decades, the energy sector has gone through a major restructuring involving significant tariff increases. This has had a large impact on private households, as large parts of the country are not served by district heat or gas, and use electricity for heating (Draginska 2004). In this environment, cost increases and the introduction of individual billing in multi-family houses with district heating have led to a decline in energy use in households, which is still nonetheless significantly higher than in Western Europe (Kostadinov 2009).

The structure of building and ownership types in Bulgaria is presented in Table 5. 1. The table also presents an overview of decision-making structures and stakeholder influence. The following section then discusses the structure of decision making as well as the main barriers and decision criteria for the major building owner types.

Table 5.1 Major owners and decision makers for residential, public and office buildings

Building and owner type	Share of total building area, %	Decision makers and types of owners
Single-family homes		
Owner-occupied	44	Home owners
Rented		Home owners / tenants upon agreement
Apartment buildings ⁶		
Owner-occupied	34	Owners collectively (67% majority)
Private rental		The owner company or co-operative / tenants (own initiative to improve comfort)
Social rental		Municipality / tenants (own initiative to improve comfort)
Public buildings		
Health and educational buildings	5	State (ministry, agency) / User of building (school, university etc.), Municipality / User of the building
Office buildings		
Owner-occupied and rental	8	Includes also public office buildings
Other	9	
Total	100	

Source: BPIE (2012).

5.2 Barriers and drivers of energy renovations among major building owner groups

5.2.1 Owner-occupied single-family buildings

Single-family houses are the most common type of residential building in Bulgaria (BPIE 2012). Most of the single-family homes are owner-occupied. Rented single-family homes and attached/semi-detached single-family homes are rare and are not discussed separately in the following. Decisions about energy renovations in residential buildings are made by the owners individually.

About two-thirds of the single-family homes are located in rural areas (BPIE 2012). According to our interviewees, there is a fairly sharp division among rural homes, with poor and less-educated residents, and the young generation buying or building a home for themselves. Many of the existing homes are in poor condition with primitive heating systems and windows; poorer home owners often can only afford to heat

⁶ Shares of owner categories can be roughly estimated as follows: Apartment buildings house about 43% of the Bulgarian population in 2010 (Eurostat 2012). Almost all of these are owner-occupied. According to Eurostat 2012, only 13% of the population lived in a rented dwelling. One the basis of these data, we estimate the following shares by tenure: owner-occupied apartment buildings 30%, social housing 3% (CECODHAS 2012), private rental 10%. These do not necessarily correspond to the floor area, but give some idea of their significance.

one room in the building. However, there is limited state support available for single-family homes, as most of the programmes are directed to renovation of the panel apartment buildings⁷.

The main barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are not critical, as renovation projects are rarely analysed at this level of detail. However, conflicting information and mistrust of information are lesser barriers (Engewald and Grätz 2010). Heterogeneous outcomes are naturally of some concern as single-family homes are diverse.
- **Financial barriers:** Initial cost is a major barrier as few households have managed to save sufficient amounts to make comprehensive renovations. Instead, renovations are done step-by-step, according to our interviewees⁸ (see also Gosselain et al. 2011). Access to capital and the cost of capital constitute another critical barrier, as loans have very high interest rates. The data collected within IDEAL EPBD (Black Sea Regional Energy Centre 2011) suggest that at least some people are unwilling to incur debt, whereas the data from Engewald and Grätz (2010) suggest that loans are relatively common in home renovations. Hence, unwillingness to incur debt can be a lesser barrier for some but not all home owners. Similarly, the resale value of property may sometimes be a minor concern.
- **Organizational problems** are naturally not a major barrier for single-family homes, as decisions are made within the household. However, the short timeframe of decisions can be a critical barrier for more comprehensive renovations, in particular, in the case of elderly home owners. Elderly people have low pensions and no bank will give them loan as the monthly repayments are higher than their incomes or do not leave enough remainder for the homeowners to survive.
- **Lack of information and skills:** Generally speaking all homeowners are interested in renovation; however, other everyday problems might draw attention from the energy renovation in the short term and move the issue for the future plans. According to our interviews, homeowners lack information and clear knowledge of the benefits of retrofitting, as well as on the impacts of retrofits on property tax levels. The home owners' lack of knowledge and need for advice is confirmed by several reports (Engewald and Grätz 2010; Black Sea Regional Energy Centre 2011). Our interviewees stressed the importance of renovation models that are adapted to the homeowners' needs and limited resources.
- **Transaction costs** are not deemed critical. However, lack of reliable and experienced service providers can be a lesser problem, especially in the countryside (Black Sea Regional Energy Centre 2011; Gosselain et al. 2011). Our experts also stressed the lack of readily available materials and installations for passive or near-zero energy homes and lack of experience among installers. High information search costs, concerns about disruption and the risk of failures are other minor problems.

Improving comfort is the most important driver for energy renovations in single-family homes, according to our interviewees (see also Black Sea Regional Energy Centre 2011; Engewald and Grätz 2010). Reduction of utility bills is another important stimulus, which all interviewees mentioned. In some cases, renovations are also initiated because the poor condition of the dwelling is hazardous to the health of residents (Black Sea Regional Energy Centre 2011).

One of our interviewees noted that people are much more aware of the need to renovate today, also due to the rising cost of energy. The renovations are not being done at a particularly high level of quality but they demonstrate that the situation is changing quickly in a better direction. The example of friends and neighbours makes a big difference, according to this interviewee, and people are eager to find solutions

⁷ However, the REECL credit line offered by retail banks is open for all kinds of homeowners. Homeowners renovating their homes can also receive a grant of up to 20-35% upon successful completion of the project (<http://www.reecl.org>).

⁸ In fact, one of our interviewees suggested that measures to promote comprehensive energy renovations should take this into account as a fact of life, and offer renovation models that can be done step-by-step and cumulatively lead to a more energy efficient home over the course of several years.

that they can implement easily themselves. Another interviewee suggested that information campaigns, legal requirements, tax reliefs and adequate loans could further stimulate renovations among single-family home owners.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for single-family homeowners:

- **Financial criteria** are among the most important. Here, especially low initial cost is valued highly, and e.g. discounts or the opportunity to pay in installments are important in decision making (Black Sea Regional Energy Centre 2011). Expected energy savings are relevant in terms of hopes to reduce the utility bills. In contrast, according to our experts, payback times and the return on investment are not clear concepts for homeowners, and they prefer to consider the cost savings.
- **Ease of renovation:** The availability of good quality service is valued, and recommendations by the social network are important (Black Sea Regional Energy Centre 2011). Easy measures that are quick to implement are of great interest (Engewald and Grätz 2010). Ease of renovation can also include the availability of insulation systems: according to our experts, e.g. EPS insulation of 5 cm is very popular and it is more difficult to find EPS 10 cm. However, these were not deemed among the most important decision criteria by interviewees, except for the availability of turnkey solutions.
- As concerns **lifetime and risk considerations**, timing is relevant but not crucial for single-family home owners, as renovations are always ongoing and are done step-by-step when money is available, according to our interviewees. Ease of maintenance and the availability of widely used solutions appear to be important criteria (Engewald and Grätz 2010); especially for renewable heating systems which are of interest in single-family homes.
- **Other benefits:** Improved comfort and better living standards are often the main driver for renovations (Gosselain et al. 2011; Barthiaux et al. 2011), which was confirmed by our interviewees.
- **Environmental and societal motives or pressures:** According to Barthiaux et al. (2011), environmental reasons are never the main reason for renovations, even though home owners are concerned about the environment. However, they tend not to trust universal solutions: “Even if their personal experience has convinced them that a certain practice is good, people become suspicious when that practice is discussed and promoted widely, as is the case with insulating dwellings and replacing old windows” (Barthiaux et al. 2011, p. 148). Hence, expected future regulations and recommendations by experts have limited impact on decisions. In fact, trust in experts seems to be comparatively low among Bulgarian single-family home owners (Engewald and Grätz 2010).

5.2.2 Owner-occupied multifamily buildings

Owner-occupied apartment buildings house about 34% of the population (BPIE 2012). Unlike many other new member states, owner-occupancy was the dominant form of apartment tenure also before 1989, and many of the problems in apartment management are inherited from those times, according to our interviewees. Traditionally, the apartment owners were not organized in any way, and it has proven legally difficult to oblige them to develop an organization for the management of the building. Although the Law on Condominium Ownership, adopted in 2009, aimed to facilitate such organization, in practice it has no effect due to many obstacles (Black Sea Regional Energy Centre 2011).

The organization of the ownership of these buildings as entities is thus still fragmented. They can basically make decisions concerning the building in two ways: by setting up a homeowners’ association or in the owners’ general assembly. Only the former is a recognized legal entity with powers to act as a collective, and only some tens of buildings are yet organized in this way, according to our interviewees. Structures are lacking for the associations to raise funds to implement building renovation activities, even though the Law on Condominium Ownership requires the establishment of a maintenance fund for this purpose (Adjarova et al. 2012; Tuominen and Koblut 2011). Additionally, multifamily houses are often managed on a volunteer basis by the residents themselves. According to our interviewees, there is a low understanding of the role

of the house manager and there is no clear definition of the maintenance and management responsibilities of owners.

Decisions concerning renovations are made by the homeowners' association, where such exists, or by the owners' assembly. A relatively high majority of 67% (in terms of ownership parts) is required to reach a decision. Banks and funds providing grants are the main external parties influencing decisions via financial means. However, our interviewees reported that funding agencies prefer to do business with one legal representative of the building, rather than a group of unorganized owners (see also Adjarova et al. 2010).

Decisions are further complicated by the diversity of apartment owners, according to our interviewees (see also Adjarova et al. 2010). Apartment owners often include many low-income and retired people, who are not capable of participating in investments.

The main barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** include one barrier rated as critical: conflicting information or mistrust of information. This relates to the social dynamic and the propensity to trust individually undertaken renovations – not standard solutions for the whole block, but individual renovations for each apartment. Heterogeneous outcomes and uncertainties concerning measurement and verification of energy savings are rated as less critical.
- **Financial barriers** include several critical barriers. High initial costs are a concern, as residents have low incomes (Adjarova 2010). Another critical barrier is access to capital and the cost of capital. The REECL offers loans for home renovations in multi-family buildings and in fact, more than 34 000 projects have been funded since 2006 (REECL 2012). However, data from the IDEAL EPBD study suggest that the bureaucratic procedures are considered to be heavy and owners prefer to fund renovations with savings, if available (Black Sea Regional Energy Centre 2011). In the case of apartment buildings, the poor level of organization of homeowners' associations seems to compound this problem and is a major barrier for comprehensive renovations. Compared to these barriers, long payback times are less of a concern, as e.g. a pilot project reported by EnEffect (2003) showed payback times of less than three years.
- **Organizational problems** include several critical barriers. These are problems in owner-occupied apartment buildings in all countries, but the problems appear to be exceptionally severe in Bulgaria. Taking a collective decision is almost impossible and people do whatever they can do for their apartments only. Even though the law requires the establishment of homeowners' associations to manage the building, this has not proven to be feasible. EnEffect (2003) reports that residents also have difficulties in reaching agreement, partly due to large differences in income levels within buildings. Moreover, homeowners' associations have little capacity to take a loan and to manage a complicated investment process such as a building renovation project (Black Sea Regional Energy Centre 2011), and as stated above, funding providers want to do business with a well-organized counterpart. A further critical barrier is the short time-frame of decision, due to the ageing population and short expected occupancy and the uncertain future of areas outside the larger cities.
- **Lack of information and skills** includes three critical barriers: lack of customer attention and interest, lack of customer knowledge and lack of reliable advice. While energy prices have risen significantly in recent years, this is from an initially low level. Moreover, as there is no tradition of joint management of common property, the need to renovate the building is not discussed among residents. Responses to rising prices are individual and not always optimal for energy saving: e.g., IRG (2007) report that several people responded to district heating price rises and the obligations to install heat meters in the early 2000s by disconnecting from the district heating system. Moreover, there are examples where individual apartment owners insulate only their own part of the outer wall (Gosselain et al. 2011). While residents are concerned about rising energy prices, they lack reliable advice on effective responses to the problem (STACCATO 2011).

- **Transaction** costs include lesser barriers. Lack of skilled service providers, high information search costs, concerns over disruption and risks of failures in renovation are rated as problems, but not critical or decisive ones.

The condition of the building and the desire to improve comfort and living standards are the major drivers for renovations in owner-occupied apartment buildings (Black Sea Regional Energy Centre 2011). Rising energy costs are another major driver. Apartment owners prefer to do renovations at once and to several building components – renovation is not seen as an ongoing activity as in detached homes (Gosselain et al 2011).

According to Gosselain et al. (2011), renovations are frequently made to individual apartments and not the whole building, which our interviewees also confirmed. Windows are replaced and insulation can be added to inner and even to outer walls by individual residents. Owners are mainly concerned about their own apartments and consensus for full-building renovation is difficult to obtain. When this does succeed, it is often due to the very bad condition of the building or total failure of building components.

According to our interviewees, a precondition for a comprehensive renovation is that the owners make decisions together concerning the whole building (see also Adjarova et al. 2010). Having a homeowners' association as a legal body is also a precondition for gaining subsidies. It is also facilitated; the Ministry of Regional Development offers a 50% subsidy from the structural funds, as well as technical and legal support for forming the association and setting up a renovation projects. However, until now, only some tens of such associations have been established.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for owner-occupied apartment buildings:

- **Financial criteria:** Initial cost is the most important criterion, along with the expected energy cost savings. Payback times can play a role if third-party financing is involved.
- **Ease of renovation:** As apartment owners prefer to do as much as possible at once and are not used to continual renovation (Gosselain et al. 2011), the role of good quality service, quick installation and turnkey solutions would be very important (although all equally unavailable in today in Bulgaria, according to one of our interviewees). Because planning especially collective renovations to whole buildings is fairly complex, the availability of a full service package could significantly facilitate the process (EnEffect 2003).
- **Lifetime and risk considerations:** Timing is important as renovations are preferably done all at once, and the most critical building components are prioritized (Bartiaux et al. 2011). Moreover, since some residents make renovations to their own apartments, they are not likely to support a common renovation if they have just invested in one of their own. Similarly important are ease/cost of maintenance and the availability of widely used solutions. For example, an ongoing demonstration programme on energy renovations in panel buildings is trying to produce such replicable solutions, which are not yet widely available in Bulgaria (EnEffect 2003).
- **Other benefits:** Improved comfort is a major driver for renovations (see also Gosselain et al. 2011). Improved value of property and social approval or status were deemed less important by our interviewees.
- **Environmental or societal motives or pressures** are not major decision criteria for apartment owners (Bartiaux et al. 2011). However, our interviewees agreed that recommendations by experts might play a role in some cases.

5.2.3 Rental housing

This section discusses the small share of housing in Bulgaria that is rented. About 3% of the residential housing stock is municipally owned and distributed on social grounds to low-income people with no housing or other property (CECODHAS 2012). This type of housing is fully owned and managed by the municipalities.

However, according to Eurostat (2012), there is also a share of the population living in private rental apartments⁹. Part of these are also owned by private persons, and hence part of the decision making in owner-occupied apartment buildings. Moreover, all municipalities started to sell out their housing stock, and as a result you may have a building with 50% (e.g.) municipally owned apartments given for rent and another 50% privately owned apartments – in this case it is even more difficult to manage the apartment block. The following discussion focuses on the municipally owned rental stock.

In rental housing, decisions are made by owners, but also tenants can initiate and pay themselves for energy renovations in order to improve the comfort and reduce the bills with or without agreement with the owner and with or without reduction of the rents for the improvements (the latter could occur, e.g., in the case of windows replacement in a municipal apartment).

The main barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** include two critical barriers: conflicting information and uncertainty concerning verification and measurement of savings. These can be critical for the following reasons: rental housing only constitutes a small share of the municipal building stock – especially small municipalities only own a few houses (Bobcheva 2009). On the other hand, according to Bobcheva (2009), larger municipalities have contracted the housing management – including maintenance and repair – to budget enterprises or trading companies. However, performance measures for maintenance and repairs are not clear. Measurement and verification of savings is particularly important for municipal rental housing because they have to prove the savings, in case of EU financing.
- **Financial barriers** are critical, especially high initial costs, long payback times and access to capital. Because municipal housing is rent-controlled, there are limitations on how large a part of the renovation costs can be charged in the rent. Revenues from rents are simply insufficient to cover the necessary investments (Bobcheva 2009). Comprehensive renovations would require additional contributions from the municipal budget, which is severely strained in many municipalities (Bobcheva 2009). Moreover, occupant take-back is a further critical barrier: because conditions are unsatisfactory, it is likely that renovations will lead to higher indoor temperatures rather than energy savings.
- **Organizational problems** include several further critical barriers. The landlord-tenant dilemma is a critical problem, since municipalities have to make investments that save energy costs for the residents. Collective decision problems are a critical barrier, especially as the municipally owned apartments are frequently located in buildings with mixed ownership (Bobcheva 2009). Moreover, in the case of social housing, municipalities have relatively short time frames in their decisions, and many municipalities are trying to sell off their housing stock (Bobcheva 2009). Public budgeting practices are a lesser problem: at least in larger municipalities, separate companies manage the municipal housing stock independently: collect the rents and make the investments (Bobcheva 2009). However, Bobcheva also reports that “The widespread municipal practice is to undertake capital repairs and maintenance on an ad hoc basis when some funds have been pledged to such a task”.
- **Lack of information and skills:** Lack of attention and interest are critical because of the low status of the social housing stock among municipal properties. Social housing would require significant investments for renovations in which the tenants are the beneficiaries, and municipalities normally prefer to invest in the renovation of e.g. kindergartens, for which they benefit themselves. Moreover, especially smaller municipalities lack knowledge and skills and renovation practices are not well-established or efficient (Bobcheva 2009). Concerns over disruption and risks of failures in renovation are lesser barriers.

⁹ Since the share of rental dwellers is larger than the figure for social housing provided by CECODHAS.

- **Transaction costs** include one critical barrier: risk of failures in renovation. This is critical for public buildings, because the investor invests the taxpayers' money, and it is important to produce good results, which is not always the case.

The municipalities are responsible for the refurbishment of the municipally owned rental housing stock and are required to develop programmes for implementation of energy saving measures in municipalities' buildings. This should also concern rental apartments, but as the municipalities often own only a small part of the dwellings in most residential buildings, the problem of the refurbishment and the energy conservation should be solved in partnership with all owners (ten Donkelaar 2007).

Moreover, the municipal housing stock has only recently passed into the hands of the municipalities, as decentralization of government property started in 1996. Municipal budget funds are limited and insufficient for investments in infrastructure; hence, municipalities try to sell off their property, especially the problematic municipal housing stock (Bobcheva 2009).

According to Bobcheva (2009) municipalities have different policies and management practices concerning renovations: small municipalities manage their housing stock themselves as part of the municipally owned building stock. Larger municipalities have budget enterprises or trading companies managing the housing stock, part of them quite independently from the overall municipal budget. Hence, the decision criteria can also vary from one municipality to another.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for rental housing owners:

- **Financial criteria** dominate: Initial costs are important because of limited budgets and insufficient rent revenues. Payback times are a related factor; however, municipalities also calculate and try to maximize their return on investment.
- **Ease of renovation** can play a certain role depending on how the management of the housing stock is organized. The availability of good quality service is of medium importance, whereas quick installation can be quite important to minimize disruption and the need for relocation. Turnkey solutions could be helpful but are not regularly used (Bobcheva 2009).
- **Lifetime considerations:** These include timing vis-à-vis previous renovations (and depletion of the renovation fund), ease of maintenance (considering the users' and house managers' limited skills) and the availability of widely used solutions. However, according to our interviewees, these are not a top priority for rental apartments.
- **Other benefits:** Improved comfort is a major driver of renovations, as the buildings are in very bad shape. However, it is not likely that the value or social status of the property would improve significantly even after renovation, according to our experts, as the apartments are rented to the very poorest of the population.
- **Environmental and societal motives and pressures** still have a limited role in decisions. In this respect, it is believed that municipalities do not differ from other types of building owners.

5.2.4 Public buildings

Public buildings are largely owned by the municipalities, which are in charge of (or share responsibility for) education, health, social services and many other responsibilities (CEMR 2010). According to Hobson (2011), the municipalities own more than 13 000 buildings, of which about 6000 are more than 1000 m² in size, and hence subject to requirements for energy audits. According to the Energy Efficiency Act, all municipalities are required to develop Energy Efficiency Programmes and achieve reductions in the buildings that they own. Moreover, buildings for which energy audits are mandatory are required to implement the audit recommendations within three years of the audit.

Banks and funds providing grants can influence decisions on renovations. For example, the Bulgarian Energy Efficiency Fund provides technical assistance to municipalities, among others, in developing energy efficiency investment projects and then assists their financing, co-financing or provides a guarantee for a loan. By 2012, 68 municipal projects have been funded (Bulgarian Energy Efficiency Fund 2012).

According to our interviewees, the state does not unfortunately set a particularly good example in energy retrofits. The legal requirements are weak and weakly monitored. Many state-owned buildings are in a poor condition and have not been renovated. Most of the retrofitting is done by municipalities, which are quite active in this area according to our interviewees, and pay for the renovations from their own budget (if available). However, there are maximum debt levels for municipalities, and hence municipalities cannot renovate all their buildings at once, but must divide them over a longer period. Moreover, one of our interviewees reported that some municipalities have long-term contracts with fuel suppliers, and hence lack the motive to cut on fuel costs.

The main barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** do not include critical barriers, as e.g. audit information provide a basis for investments.
- **Financial barriers** include several critical barriers. A large share of the public buildings are owned by municipalities, which cannot set the rate of local taxes, and are largely dependent on subsidies by the central government (Rezessy et al. 2006). Our interviewees also reported that the cost of capital is very high in Bulgaria (6-9%), and there are restrictions on municipal debt. Lack of funding is a widespread problem. Moreover, our experts reported that because conditions are fairly poor, the main priority is to improve comfort and working conditions; hence, expected savings might not accrue due to higher temperatures.
- **Organizational problems** include one critical barrier: public budgeting practices. According to Rezessy et al. (2006), this is a barrier especially for municipalities. If municipal expenditures are decreased due to energy efficiency measures, state subsidies are curtailed, which reduces the motivation of local authorities to cut their energy expenses.
- **Lack of information and skills:** In principle, public authorities should have access to all kinds of knowledge and information. However, in this category, lack of attention and interest is deemed a critical barrier. Public authorities have several responsibilities and problems demanding their attention, and the energy efficiency of buildings is only one of these, often not considered the most urgent. However, according to our interviewees, knowledge levels have increased significantly in the past few years, and there is networking among and within municipalities of energy efficiency experts.
- **Transaction costs** are not considered to include any critical barriers for Bulgarian public building owners. Public building owners usually have some level of market power, and can thus gain appropriate services and manage renovation processes better than individuals. However, like for the other groups, lack of skilled service providers, high information search costs, concerns over disruption and risks of failures all contribute to making energy efficiency investments difficult.

Most public buildings in Bulgaria are in poor condition. For example, the Ministry of Regional Development and Public Works (2010) estimated that the majority of buildings of educational institutions (both state-owned and municipally owned) are in urgent need of rehabilitation because of their poor physical condition due to the very low level of maintenance expenditures (both municipal and state). In a significant part of the buildings, installations are obsolete and poorly maintained, and buildings are poorly insulated. Moreover, the condition of public buildings (cultural, educational and health) is also unsatisfactory, especially in villages.

An important driver are the energy audits required in public buildings of more than 1000 m² (Kostadinov 2009). The state-owned and municipal buildings audited by now are mostly hospitals, social care institutions, schools, universities and office buildings of central and local administrations. Audit

recommendations include recommendations to improve insulation, the operation of building installations for heating, domestic hot water systems, ventilation and lighting installations.

According to our interviewees, administrators in municipalities are more educated and motivated in energy issues than other building owners. There are significant funds (40 MEUR) allocated for improvement of the energy efficiency of educational buildings under the Operational Programme Regional Development, 85% of which is contributed by the ERDF. There are also funds (more than 75 MEUR) allocated to renovation of health care buildings (Ministry of Regional Development and Public Works 2010). However, the beneficiaries need to contribute 15% of their own funding, and this may be difficult to find considering the poor state of public finance.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for public buildings:

- **Financial criteria** dominate. Due to problems in accessing capital (Rezessy et al. 2006), especially initial costs are key decision criteria for public buildings, but according to our interviewees, administrators are well-educated today and pay attention to payback times and returns on investment, as well.
- **Ease of renovation:** Especially quick installation can avoid interruptions and relocations, and turnkey solutions can be particularly important to save scarce personnel resources. There has been a great interest in the Bulgarian public sector in ESCO and EPC funding, which often offers technical advice and other types of full service (Kostadinov 2009).
- **Lifetime and risk considerations:** Timing of investments vis-à-vis previous renovations has quite some importance, since investments need to be prioritized. Another important criterion, according to our interviewees, is the availability of widely used solutions, which can facilitate the process.
- **Other benefits:** Improved comfort can be a powerful driver for renovations, according to our interviews, especially in schools, kindergartens and hospitals. Improved value of property has a medium-level importance: In rural areas, much of the public building stock is unsellable, in any case. However, social (political) approval can be a very important driver for the renovation of public buildings, according to our interviews.
- **Environmental and societal motives and pressures** are slightly more important for public buildings than for residential buildings. The state and municipalities have explicit responsibilities concerning the environment and some municipalities have even taken voluntary action in this area (LG Action 2012). Expected future regulation mainly concerns the state (as the Energy Efficiency Directive now only concerns buildings owned by central government). Recommendations by experts, however, are deemed an important decision criterion by our interviewees. This is because audits are obligatory for public buildings, and include recommendations by the experts conducting these audits.

5.2.5 Owner-occupied office buildings

Office buildings make up a relatively large share of the Bulgarian housing stock (8%), which however also includes public sector office buildings (BPIE 2012). The exact distribution between professionally owned and owner-occupied office building space in Bulgaria is not known. However, ELTA Consult (2009) reported a share of about 15% of owner-occupied office space among the Grade A and B office properties in Sofia.

There has been a high rate of new office space construction in recent years, which might reduce the owners' interest in renovations. According to our interviewees, some owners of older office buildings might be interested in renovations, but most of the office buildings are new.

The main barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are not the main barriers for owner-occupiers. Energy efficiency projects can be analysed at this level of detail, but management attention focuses on other issues, according to our experts.

- **Financial barriers** include several critical barriers: high initial costs, long payback times, access to capital and unwillingness to incur debt for investments in energy efficiency are all critical barriers. This is because businesses want to retain their capital for productive investments rather than investments in their premises (even if they reduce costs). Energy costs are only a small share of the office owner-occupiers total costs, hence they are not the first category of costs targeted.
- **Organizational problems:** Collective decision making can be an important barrier, at least in multi-occupancy buildings. There are collective organs to take decision in most cases, and they are elected for a given mandate.
- **Lack of information and skills:** Lack of customer attention and interest is deemed a critical barrier. This is because management attention is directed to other issues than the energy efficiency of the business premises. Especially office owner-occupants rarely have staff dedicated to energy efficiency issues, according to our experts.
- **Transaction costs** are lesser barriers for office owner-occupants as they have the market power to overcome such problems.

There are few drivers for office owner-occupiers to invest in energy renovations. In some cases, the condition of the building may be a driver. Improved comfort and ensuring good conditions for work are the main motivations. On the basis of our expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are dominant in a business environment. However, compared to ordinary dwelling owners, business professionals are likely to place an equal importance on return on investment as on initial costs and payback times.
- **Ease of renovation** is important, including the availability of good quality services and turnkey solutions. Quick installation is important in order to avoid disruption and the associated costs.
- **Lifetime and risk considerations** are important, according to our interviewees, including timing vis-à-vis previous renovations and ease of maintenance. The availability of widely used solutions is less important for office building owners, as they are more likely than the others to try out unusual solutions.
- **Other benefits:** Improved comfort is the main criterion for initiating renovations, including energy related ones. Similarly, improved value of the property and social status can be important criteria.
- **Environmental and societal motives and pressures** are not a priority for Bulgarian office building occupants in general, as they have several other priorities, and environmental pressures are mainly felt by companies in natural resource sectors (UNDP 2007). However, expected future regulations and recommendations by experts are likely to influence the decisions of some office owner-occupants, as they are sensitive to regulation and changing expectations, according to our interviewees.

5.2.6 Rental office buildings

The overall situation of rental office buildings is fairly similar to that of owner-occupied offices. However, the main barriers to energy renovations are somewhat different than in the case of office building owner-occupiers, and can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** involve several critical barriers. Building maintenance is a much larger factor in the cost structure for professional office space owners. Hence, investments need to be analysed carefully and uncertainties make it difficult to produce a detailed investment calculus.
- **Financial barriers** include several critical barriers: high initial costs, long payback times, access to capital and unwillingness to incur debt for investments in energy efficiency are all critical barriers. This is because businesses want to retain their capital for productive investments. For example, professional office space owners might prefer to construct a new building and charge higher rates

for it rather than to invest in renovating an old building. Location is also critical for the rental values commercial office space.

- **Organizational problems:** The landlord-tenant dilemma is deemed a critical barrier. If the owner invests in energy efficiency, it is the tenant that benefits due to lower energy costs. Normally tenants pay for their own energy costs, for electricity in almost all of the cases, also for heating, but rarely for cooling (in some cases heating and cooling cost distribution could be based on space area). Collective decision can present problems in terms of bureaucracy.
- **Lack of information and skills:** Lack of customer attention and interest is deemed a critical barrier. This is because customer attention is directed to other issues than the energy efficiency of the business premises, and energy efficiency is not an important criterion in marketing office space.
- **Transaction costs** do not include critical barriers for providers of rented office space. These are usually professional property developers, which have market power to contract good quality service and avoid risks of failure.

Comfort and improved working conditions are the main drivers for energy renovations, and they are also the main topics in the Bulgarian corporate social responsibility debate (UNDP 2007). Cost issues can also be drivers of office building renovation, as can the availability of funding programmes. On the basis of our expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are dominant in a business environment. However, compared to ordinary dwelling owners, business professionals are likely to place an equal importance on return on investment as on initial costs and payback times.
- **Ease of renovation** is important, including the availability of good quality services and turnkey solutions. Quick installation is important in order to avoid disruption and the associated costs.
- **Lifetime and risk considerations** have an above-medium role, including timing vis-à-vis previous renovations, ease of maintenance and the availability of widely used solutions.
- **Other benefits:** Improved comfort is the main criterion for initiating renovations, including energy related ones. Similarly, improved value of the property and social status can be important criteria. Our interviewees stressed the possibility of attracting good tenants and gaining higher rents via better office buildings.
- **Environmental and societal motives and pressures** are not a priority for Bulgarian office building occupants in general, as they have several other priorities. However, expected future regulations and recommendations by experts have are likely to influence the decisions of office owner-occupants, as they are sensitive to regulation and changing expectations, according to our interviewees.

5.3 Discussion on barriers and drivers for energy renovations

The Bulgarian situation is changing very rapidly in terms of general awareness and interest in energy issues, also as a result of rising energy prices. According to our interviewees, there were no discussions and no instruments 5-10 years ago, and now there are several measures in place to stimulate renovations.

However, there are still several barriers to more comprehensive energy renovations, which are summarized in Table 5.2. Two financial barriers are critical for all owner groups: high initial costs and access to capital and/or the cost of capital. A particular problem in Bulgaria are the owner-occupied apartment buildings, most of which still lack any capacity for common, comprehensive renovations because they are rarely organized as legal entities. This is important because they constitute a fairly large share of the total building stock. Moreover, while attention to and interest in energy issues has increased significantly, this is from a very low initial level and in a context where people have several other issues and concerns. Hence, lack of attention and interest is still considered a critical barrier for most owner groups, and lack of customer knowledge is critical for residential building owners.

Table 5.2. Most widespread and critical barriers among different building owner groups. Barriers rated critical are indicated in red and less critical ones in orange.

	Single-family homes	Owner-occupied apartment buildings	Rental apartment buildings	Public buildings	Owner-occupied office buildings	Rental office buildings
Genuine uncertainties regarding cost effectiveness						
Conflicting information, mistrust of information						
Heterogeneous outcomes						
Uncertainty in measurement & verification of savings						
Financial barriers						
High initial costs						
Long payback time						
Access to/cost of capital						
Unwillingness to incur debt						
Occupant take-back						
Low/uncertain resale value of property						
Organizational problems						
Landlord-tenant dilemma						
Collective decision problems						
Short timeframe of decisions						
Public budgeting practices						
Lack of information and skills						
Lack of customer attention and interest						
Lack of customer knowledge						
Lack of reliable advice						
Unsophisticated financial analysis						
Transaction costs						
Lack of skilled service providers						
High information search costs						
Switching costs, concerns over disruption						
Risks of failures in renovation						

Source: interviews and literature as presented above.

In spite of these barriers, there are also several drivers for energy renovations. The rising price of energy, increasing awareness and public discussion, and several government, municipal programmes and NGO programmes were mentioned as important factors by our interviewees. On the basis of this review (see also Adjarova et al. 2010), the main parties influencing renovations are:

- **The state** has placed a special focus on panel buildings, for example in the National Programme for the Renovation of Residential Buildings. It also supports municipalities.
- **Municipalities** have been particularly active in Bulgaria. They have common networks of experts and provide information to other building owner groups. For example, the municipalities have the responsibility to support homeowners' associations in relation to the National Programme for Renovation of Multifamily Buildings (Trainrebuild 2011).

- **NGOs**, such as the Bulgarian Housing Association and EnEffect, are working to get building owner organized and to offer information and technical support for building owners.
- **Banks** could play an important role in financing energy renovations. However, as noted above, they have difficulties in dealing with unorganized multifamily housing owners, and commercial interest rates are high due to a high level of uncertainty in the market. This is why other dedicated finance instruments such as Bulgarian Energy Efficiency Fund and the Residential Energy Efficiency Credit Line (REECL) are very important.
- **Companies offering solutions:** Designers, architects and engineers working with energy efficient solutions can play an important role, as can construction companies and installers. Other relevant companies include e.g. auditors issuing energy performance certificates.
- **Educational institutions** play an important role in education a new generation of professionals and introducing new solutions.

Table 5.3 presents a summary of the decision criteria identified in our study as important for different building owner groups in the Bulgaria. Two criteria stand out as being important for all groups: initial cost and improved comfort. The availability of good services and especially turnkey solutions for renovation and also priorities for several groups, as are the examples of widely used standard solutions, which are still lacking for many types of buildings in Bulgaria. However, energy efficiency seems to be rising on the agenda, as public sector organizations and office buildings are deemed to gain social approval through well-renovated buildings.

Table 5.3. Most important decision criteria for the major owner groups.

Criteria	single-family homes	owner-occupied apartments	rental apartments	public buildings	owner-occupied office buildings	rental office buildings
Financial						
Initial cost						
Payback time						
Return on investment						
Ease of renovation						
Quality service available						
Quick installation						
Turnkey solutions available						
Lifetime and risk considerations						
Timing vis-a-vis previous renovations						
Ease of maintenance						
Widely used solution						
Other benefits						
Improved comfort						
Improved value of property						
Social approval/status						
Environmental/societal motives/pressures						
Environmental considerations						
Expected future regulation						
Recommendation by experts						

Source: interviews and literature as presented above.

6. CZECH REPUBLIC

6.1 General overview

In the Czech Republic, the average age of the building stock is relatively high (about 50 years). Several authors report a neglect of maintenance and renovation, which has resulted in poor conditions of buildings (Pejter and Gebauer 2010; Galda and Kubenkova 2007; Temelova et al. 2011). A particular feature of the residential building stock is a large share of panel buildings, i.e., large apartment blocks constructed of pre-fabricated, pre-stressed concrete. Panel buildings, constructed since the 1950s, make up the largest share of individual building types, and house almost one-third of the population (Galda and Kubenkova 2007 ; Temelova et al. 2011).

The Ministry for Regional Development is in charge of housing policy in the Czech Republic. Energy policy, and e.g., the Energy Performance Certificate, is the responsibility of the Ministry of Industry and Trade. Mandatory energy efficiency standards exist for new buildings and also for buildings undergoing deep renovation (Regulation No. 148/2007). However, the energy efficiency standards in the 1960s and 1970s, when a large share of the current buildings were built, were not very stringent (Pejter and Gebauer 2010).

Several programmes have been launched to support modernization (including energy efficiency improvements) of housing in the Czech Republic.

- The PANEL programme (2001-) supports the renovation of prefabricated panel buildings through an interest subsidy, a bank guarantee for credit and specialized technical assistance (Galda and Kubenkova 2007). There is a specified list of efficiency improvements that applicants must make, including insulation, improved heating systems, and use of renewable energy; however, there are no strict energy performance criteria for the basic level of support (UK Green Building Council 2011). About one-third of the panel houses have been renovated by now (Karasek and Ubralova 2012). The NEW PANEL programme subsidizes also apartment buildings constructed by “non-panel” technology.
- The Green Light for Savings Scheme (2009-2012) was administered by the Ministry of Environment and has provided generous (>50%) subsidies for thermal insulation and heating sources based on renewable energy (Zámečník and Hlaváč 2011). The precondition for the subsidy is the commitment to reduce the need of energy for heating below 55 kWh/m²/a, and at the same time to reduce the consumption of the heat by at least 40% after the completion of the reconstruction (Vanicek 2011). The scheme also provided a subsidy bonus for selected combinations of measures. Only accredited suppliers and products listed by the Ministry of Environment are eligible for the programme subsidy. The Czech Republic has raised funds for this programme from the sale of emission credits under the Kyoto Protocol on greenhouse gas emissions (UK Green Building Council 2011). The programme has been very successful in promoting ambitious energy renovations (Zámečník and Hlaváč 2011).
- Operational Programme Environment (OPE) offers more than 5 billion EUR from various European and national funds for ecological projects, including sustainable use of energy, renewable heat and electricity and the use of waste heat. This fund has, e.g., successfully supported energy renovations in public buildings in about 1500 projects (UK Green Building Council 2011).
- There are several energy service companies (ESCOs) in the Czech Republic providing energy performance contracting. The energy performance contracting market is increasing, but there are many administrative barriers to its rapid development. Usually the administration takes more time than is expected.

Energy performance certificates (EPCs) are mandatory for new buildings with more than 50m² of floor area (except industrial and agricultural buildings) and for major renovations of building with more than 1000m² of floor area. The EPCs are required in building permitting phase. Further, EPCs have to be displayed in public buildings with more than 1000m² of floor area. EPCs are not required in case of selling or renting a building or its part (this obligation should start in January 2013 with relevant law recast, implementing

EPBD 2 as well. After this recast comes into force (should start on 1.January 2013), the EPC obligation should be broadened to more renovations (not only major ones) and to selling and renting buildings or parts of buildings. The EPC itself as well as some details of calculation methodology will be changed. A recommendations chapter is a part of the EPC, but it is usually filled in only in case of EPCs for renovations or public buildings.

Table 6.1 presents an overview of the major building owner types and decision makers in the Czech Republic. The following chapter then provides more detail on decision structures, barriers and decision criteria among these major owner types.

Table 6.1 Major owners and decision makers for residential, public and office buildings

Building and owner type	Share of total building area m ² , %	Decision makers and types of owners
Single-family homes		
Owner-occupied	38	Owner-occupant
Rented	4	Landlords: mainly housing associations or public bodies
Apartment buildings		
Owner-occupied	27	Owner
Co-operative rental	4	Owner / management of housing co-operative
Social rental	3	Municipality
Public buildings		
State	10	State institution / municipality
Local government		
Commercial office buildings		
Owner-occupied	9	Owner
Rental		Owner
Other	5	
Total	100	

Source: Calculated according to Czech Statistical Office

6.2 Barriers and drivers of energy renovations among major building owner groups

6.2.1 Owner-occupied single-family buildings

Single family houses constitute about 42% of all dwellings, and most of these are owner-occupied (Czech Statistical Office 2011b). Owners make decisions on their own, and are mainly influenced through voluntary incentives by the state (e.g., the Green Light for Savings scheme discussed above), and by advice available in the public discussion.

In terms of socio-economic and demographic features (Czech Statistical Office 2011b), single-family homes are owned by all income groups. However, there is a difference between urban and rural regions. According to the Czech Statistical Office (2011b), single-family buildings are more common in small municipalities (rural areas), whereas there are only slightly more than 100 000 single-family buildings in municipalities with a population of more than 100 000 inhabitants (i.e., larger towns and cities).

A qualitative study for the IDEA-EPBD project examined the drivers and barriers of single-family home owners that had recently conducted renovations, and their motivations to include energy improvements in their renovations (ten Donkelaar 2011). It was found that the need to replace a building part or make a general improvement of a home were the most important occasions for renovation, as well as a desire to extend the house. It was also found that renovations in single-family homes are often done step-by-step.

The most important barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness:** The literature (ten Donkelaar 2011) and our interviews suggest that contradictory information and mistrust of information is a critical barrier for single-family homeowners (for example, contradictory information from construction experts).
- Among **financial barriers**, high initial costs, long payback times and unwillingness to incur debt are deemed critical. This is supported by e.g. the interviews with Czech homeowners (ten Donkelaar 2011), where lack of money and indebtedness were reported as important barriers and the main reasons why even technically necessary renovations were done in small pieces. The interviews by ten Donkelaar (2011) also suggest that some homeowners do not make use of the national subsidy scheme, Green Light for Savings Programme, because it requires comprehensive renovations, which raise the initial cost of the renovation work, even though generous grants are provided.
- **Lack of information and skills:** Lack of customer attention and interest and lack of customer knowledge are deemed critical, according to our interviews¹⁰. More detailed information on appropriate renovation options is evidently lacking among the majority of homeowners, and the focus on initial costs overshadows lifecycle considerations. Homeowners are to some extent aware of energy costs, but may prefer to respond through operational measures rather than by investing in renovations (ten Donkelaar 2011).
- Among **transaction costs**, lack of skilled service providers, high information search costs, switching costs and risks of failure are as lesser barriers (however, see Tuominen and Klobut 2011). However, ten Donkelaar (2011) reports that some home renovators were very dissatisfied with the work of craftsmen. Some of the homeowners were critical about the knowledge level of craftsmen, and there were reports of renovations that had gone badly wrong.

There are, however, also several drivers for energy renovations for single-family house owners in the Czech Republic. These include the technical need to renovate building components (and improve energy performance at the same time), the rising price of energy, as well as successful examples from neighbouring countries, Austria and Germany (Vytláčil 2007; Hájek and Tywoniak 2007; ten Donkelaar 2010).

More recently, some state finance has also been offered to support single-family home owners. Most notably, the Green Lights for Savings Programme mentioned above has been used by tens of thousands of single-family houses (Zámečník and Hlaváč 2011). A recently discontinued programme for funding solar PV installations also raised interest among homeowners (Hájek and Tywoniak 2007).

On the basis of our literature review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial motives** are among the most important reasons for energy renovations. In particular, the opportunity to save money on energy costs is a major driver. However, low initial costs often determine the selection of solutions (ten Donkelaar 2011), whereas payback times and return on investment are more rarely considered.
- **Ease of renovation** does not seem to be a major expectation among homeowners in the Czech Republic (ten Donkelaar 2011, our interviews). However, the availability of quality service and turnkey solutions can make some difference in the decisions of homeowners.

¹⁰ However, according to ten Donkelaar (2011), many of the homeowners interviewed knew that window replacement and roof and wall insulation would save money (however, most of these interviewees were aged below 40, and use the Internet to find information).

- **As concerns lifetime and risk considerations**, ten Donkelaar suggests that the (perceived) technical need to renovate or replace a building part, also due to the cost of energy, was the strongest driver for renovations, e.g. replacement of windows or roofs because they were worn out. Energy efficiency improvements could be included in such renovations in order to make sure that it is done well once it is done. Ease of maintenance may be important for some types of renovations, such as new heating systems, and this was confirmed by our interviewees. Our expert interviewees did not believe that widely used solutions are among the most important criteria, however ten Donkelaar (2011) reports that the interviewees made window renovations because they are typical improvements to single-family homes, and that renovations by acquaintances and companies' references were often mentioned as examples.
- **Other benefits:** Improved comfort is a major driver for energy renovations, according to our interviewees. This could include having a warmer home or extending the home while also making energy improvements (ten Donkelaar 2011). Considerations concerning the improved value of the property, and to a lesser extent, also social approval or status might play a smaller/variable role in the decision to renovate.
- **Environmental and societal motives or pressures:** According ten Donkelaar (2011), energy savings were mentioned quite often as a reason for certain measures such as insulation or window replacement. However, the motives are still more economic more than environmental. Recommendations by experts, e.g. technical professionals, can play a certain role (ten Donkelaar 2011), but not a major one for homeowners, according to our expert interview.
- **A further possible decision criteria** mentioned by ten Donkelaar (2011), is the availability of subsidies. This is not mentioned as decisive for making a renovation, but as a factor that can influence the scope of a renovation and encourage people to make renovations that they would have liked to do but could not afford.

6.2.2 Owner-occupied apartment buildings

Unlike several other transition countries, tenants in the Czech Republic did not automatically acquire the right-to-buy their formerly state-owned flats (Sunega and Bezovan 2007; Lux 2009). However, municipalities have actively sold their housing stock, so owner-occupancy has grown in the past years (Lux 2009):

About 27% of all dwellings are owner-occupied apartments (Czech Statistical Office 2011a). The common premises of such apartment buildings are governed by housing unit owners' associations and managed by a minimum three-member board. Decisions concerning renovations and modernization require a 75% majority of housing unit-owners' votes (Karasek and Ubralova 2012). Typically, specialized facility management companies are used for the financial issues of the owner occupied buildings; however, the owners are the most important decision makers. In some cases they use consultants.

Owner-occupied apartments are somewhat more typically owned by people with higher incomes According to the Czech Statistical Office (2011b), 36% of apartment owners were in the highest income decile, whereas 19% were in the lowest income decile.

The most important barriers to energy renovations can be summarized as follows:

- As concerns **genuine uncertainties regarding cost effectiveness**, conflicting information, heterogeneous outcomes and uncertainty concerning measurement and verification of energy saving are rated as critical barriers by our experts. As a large majority (75%) of owners is needed to make the decision on renovations, and defining the cost-optimal level of renovations is often a subject for discussion when making these decisions, several considerations need to be taken into account, such as interest rates and energy prices (Hazucha 2009).
- **Financial barriers** include several critical ones. High initial costs and long payback times are perceived by owner-occupants as severe barriers (Hazucha 2009). Moreover, access to capital is also a critical barrier for owner-occupiers (Hazucha 2009). According to Karasek and Ubralova (2012),

when loans are needed for financing renovations, banks usually require that all the apartments in the building are used as collateral, but some owners usually refuse to do so. Lesser barriers include unwillingness to incur debt, occupant take-back, low monthly payments and low or uncertain resale value of property. A study by Temelova et al. (2011) suggests that real estate prices for panel buildings in some regions can be as low as 15% of the corresponding prices in Prague, which is likely to discourage renovation. Since property values depend on the quality of the entire physical environment, complete regeneration of entire areas may be necessary to stop the process of urban decay (Temelova et al. 2011).

- Among **organizational problems**, difficulties in reaching collective decisions among owners are rated as a critical barrier. As stated above, a fairly large majority of 75% is needed to make decisions on renovations. Moreover, according to Karasek and Ubralova (2012), all apartment owners are parties in the renovation process (i.e., power is not delegated e.g. to the board), and all owners co-apply for a building permit, regardless of whether they have sanctioned the process. Moreover, Hazucha (2009) reports that building owners sometimes even start legal processes to stop renovation plans. The landlord-tenant dilemma is also a critical barrier: in this case, it refers to the different interests of different co-owners.
- **Lack of information and skills:** Our interviews suggest that lack of customer attention and knowledge are critical barriers. Detailed knowledge of energy efficiency and the most cost-effective solutions is clearly lacking, and may not always be available through architects or engineers, either (Hazucha 2009). However, this may be rapidly changing, as Karasek and Ubralova (2012) report that most apartment owner-occupiers are aware of the cost of energy. The approved solutions and services offered on the Green Light for Savings Programme website may to some extent ameliorate the lack of knowledge, which is also improving also through the discussion on EPBD Recast implementation. Unsophisticated financial analysis and lack of reliable advice are deemed lesser barriers. For example, Hazucha (2009) mentions that static payback methods tend to favour short lifecycles with smaller energy savings in order to reach the shortest payback times.
- **Transaction costs** include several critical barriers, according to our interviews. These include lack of skilled service providers, concerns over disruption and changes in the building, as well as risks of failures in the renovation. For example, Hazucha (2009) mentions several potential pitfalls in the planner selection, contractor selection and realization phase, which may require the involvement of such experts as lawyers, building inspectors and external engineering inspectors.

Awareness of energy costs and the need to save energy are however increasing rapidly among apartment building owner-occupants (Karasek and Ubralova 2012). Other drivers include the technical state of the building and the necessity to make renovations. There is widespread recognition of the need to renovate apartment buildings and improve energy performance, which is further supported by the availability of several grants, especially for panel buildings.

Renovation of panel buildings is further stimulated by the availability of replicable standard solutions (Hazucha 2009; Karasek and Ubralova 2012). It is estimated that 20% of the building stock has been renovated in the past decades, but more comprehensive energy renovations are still rare (Hazucha 2009).

On the basis of our literature review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are important for energy renovations. As mentioned above, awareness of energy costs and the need to save energy are relatively high among apartment owner-occupants (Karasek and Ubralova 2012). The importance of initial cost (in particular) as well as payback times and returns on investment were confirmed by our interview, and are highlighted by the widespread popularity of government subsidy programmes such as the PANEL programme and the Green Light for Savings programme (Karasek and Ubralova 2012).
- Under “**ease of renovation**”, the availability of quality service can be a key factor in decision making, and can influence, e.g., the depth and scope of renovations (Hazucha 2009). In contrast, quick installation and turnkey solution (i.e., full service delivery) are not rated as major decision

criteria, which is backed up by Hazucha's (2009) observation that apartment owners tend to do piecemeal and partial renovations in order to avoid high initial costs.

- **Lifetime and risk considerations** have medium weights as decision criteria. Since about 2/3 of the apartment buildings are still not renovated, previous renovations play a minimal role, but on the other hand, the need for urgent renovation does factor in decisions about energy renovations, as well; typically concerning the insufficient state of windows and roofs. Ease of maintenance and use has some value for apartment owners, e.g. for new ventilation systems and radiators (Hazucha 2009). The exemplary effect of widely used solutions and good experiences from them is mentioned by Karasek and Ubralova (2012). Our interviewee, however, did not see this as a key factor (perhaps because this is so widely available that it does not make a difference).
- **Other benefits:** Our expert interview suggests that improved value of the property can be an important decision criterion for apartment owners. Our interviewee considered improved comfort to be somewhat less important, but e.g. Karasek and Ubralova (2012) and ten Donkelaar (2011) suggest it is the main driver for renovations.
- **Environmental and societal motives and pressures** have a somewhat smaller role in owner-occupied apartment buildings than in single-family homes due to the collective nature of the decision making. Our expert interview confirmed that environmental concern, expected future regulation and recommendations by experts are minor concerns.

6.2.3 Rental apartment buildings: housing co-operatives

About 11% of all dwellings are in co-operative housing (Czech Statistical Office 2011a), which is somewhere between owner-occupied and rented. Housing co-operatives consist of apartments leased to particular members, but co-owned by all members of the co-operative. Co-operative housing also can be inherited or transferred to another person (Sunega and Bezovan 2007; Lux 2009), but cannot be used as collateral by individual members (Karasek and Ubralova 2012).

Co-operative members' powers concerning the building are similar to that of direct ownership. The co-operative is governed by an elected board, but large decisions like renovations require a majority vote by the co-operative members' meeting (Karasek and Ubralova 2012). Renovation processes are governed by the board. Facility managers have a key role in preparing decisions on renovations. The largest housing co-operatives are managed by professionals (CEDOHAS 2012). These larger co-operatives have their own facility management service offices. Besides their own flats these larger co-operatives administer dwellings of associations of private owners. Smaller housing co-operatives can be managed by volunteers.

All income groups are fairly similarly represented in co-operative housing. Co-operative housing is particularly popular among younger people and the older generation (Czech Statistical Office 2011b).

The most important barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost effectiveness** include one barrier that is rated as critical for this group, conflicting information and mistrust of information. This is critical because there is often a big difference between calculated savings and real savings, which is usually caused by the user behavior. However, the situation should improve, as co-operative apartment buildings are often panel buildings, of which there are only fifteen fundamental types in the Czech Republic, and there is a high degree of coordination of construction permits to find the best technical and economic solutions for retrofits (Karasek and Ubralova 2012).
- **Financial barriers** are as a group the most difficult barriers for co-operative housing (Karasek and Ubralova 2012). Among these, high initial costs, long payback time and access to capital and/or the cost of capital are rated as critical barriers by our interviewee. This is confirmed by Karasek and Ubralova (2012), who report that the average sum spent on restoration and thermal insulation of one apartment is about € 16,000, which corresponds to the average Czech housing costs for about 6 years (Czech Office of Statistics 2011b). Moreover, loan applications may be complicated due to

the lack of clarity about apartment ownership (some individual apartments may be in private ownership) (Karasek and Ubralova 2012). Loans need to be guaranteed by each member or by the co-operative on the part of those who do not agree to this. In some cases, loans are impossible to obtain, and renovations are restricted to what can be funded from the house maintenance fund (Karasek and Ubralova 2012). Critical barriers also include occupant take-back, according to our interviewee.

- **Organizational problems:** Collective decision problems are frequently critical, even though they might not be as severe as in the case of owner-occupied housing due to the simple majority required to make decisions on renovations. Karasek and Ubralova (2012) suggest that at least larger housing co-operatives have renovation plans and procedures in place, but there are difficulties in convincing the landlord-tenants. Our interviewee also stressed the importance of the landlord-tenant dilemma.
- As concerns **lack of information and skills**, lack of customer attention and interest and lack of customer knowledge are rated as critical. Karasek and Ubralova (2012) report on a case study concerning a large housing co-operative which has a well-organized approach to energy renovations, and which also makes sophisticated economic calculations to determine the rate of return on energy investments. They also mention that larger housing co-operatives accumulate knowledge and experience of e.g. good contractors. However, the problem is to convince the residents.
- **Transaction costs:** Our interviewee highlighted the lack of skilled service providers and concerns over disruption as major barriers (see also Karasek and Ubralova 2012). Risks of failure are deemed lesser problems than in owner-occupied housing, which is logical because the co-operatives usually constitute a large contracting unit, making it easier it is to avoid or mitigate such problems.

The technical need for renovation is a major driver for renovations in housing co-operatives, the majority of which are located in panel buildings (Vanicek 2011). Awareness of energy costs and the need to save energy are also high on the agenda, especially for the larger housing co-operatives (Karasek and Ubralova 2012). The larger co-operatives are also fairly well-organized with the ability to gain professional help and advice and exchange good experiences (Vanicek 2011; Karasek and Ubralova 2012).

Karasek and Ubralova (2012) also mention the available subsidies as a major driver, as well as the relative ease of finding standard solutions for the renovation of panel buildings. Government subsidies have had a large impact on panel housing renovations in the Czech Republic, and Karasek and Ubralova (2012) believe that if they are discontinued, renovation rates will fall significantly.

On the basis of our literature review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are key drivers for energy renovations in housing co-operatives (Karasek and Ubralova 2012), which are well aware of the cost of energy. Even though the larger co-operatives can have quite sophisticated financial planning systems, initial costs are still an issue because of the difficulties in raising finance. Hence, renovations are often done in two phases (Karasek and Ubralova 2012). However, payback times and returns on investment play a lesser role in the decision, according to our interview.
- **Ease of renovation** facilitates the reaching of decisions on renovations. Large housing co-operatives contract engineering companies to coordinate renovation projects (Karasek and Ubralova 2012). Hence, the availability of turnkey solutions is an important factor influencing decisions.
- **Lifetime considerations** play intermediate roles. As mentioned above, housing co-operatives often divide major renovations into smaller steps in order to secure finance. Ease of maintenance is important when diverse users, technicians and house custodians need to maintain new building systems. Moreover, the existence of widely used solutions facilitates decisions energy renovations; such widely used solutions are today available for the most common types panel buildings in the Czech Republic (Karasek and Ubralova 2012).

- **Other benefits:** Our interviewee rated improved comfort as one of the main decision criteria. This is confirmed by Karasek and Ubralova (2012) mention several co-benefits related to comfort and amenity (e.g. building aesthetics and the opportunity to changes the grey façade) as well as social issues like improvement of tenant loyalty and overall image and value of the buildings and the area.
- **Environmental and societal motives:** Professionally managed housing co-operatives strive to fulfill their responsibilities (Karasek and Ubralova 2012), but on average, our interviews suggested that environmental considerations or expectations about future regulation play a minor role in decisions today. However, recommendations by experts were judged to play a role in some cases (see also Karasek and Ubralova 2012).

6.2.4. Rental apartment buildings: municipal

About 18% of all dwellings are rented apartments (Czech Statistical Office 2011a), the majority of which are owned by the state or municipalities. Of these, about two-thirds are rented on the open market, whereas about one-third have regulated rent (Czech Statistical Office 2011b); however, rental regulation is to be dismantled starting in 2011 (Karasek and Ubralova 2012). While the decision-making concerning renovations is simple in the case of one owner (private or public), state regulated rents have been a problem until now, as this makes it difficult to pass the costs of renovations into rents (Karasek and Ubralova 2012).

Municipalities own a large share of the rental apartments in the Czech Republic (Karasek and Ubralova 2012; CECODHAS 2012b). Because there is no official definition of social housing in the country, municipally owned apartments are considered here in this context, even though older municipal apartments were not distributed on social grounds (CECODHAS 2012b). Municipal decisions are largely dependent on the municipal budget and its priorities and constraints, as well as on rules for public procurement procedures.

Rented apartments are more commonly inhabited by somewhat poorer people, but not necessarily. According to Czech Statistical Office (2011b), 19% of the people living in rented apartments were in the highest income decile vs. 28% in the lowest. However, municipal social housing hosts a relatively large number of elderly residents.

The most important barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost effectiveness** are similar to those in co-operative housing (see previous chapter), largely because the types of buildings are largely similar. Conflicting information and distrust of information was deemed a critical barrier by our interviewees for all types of buildings.
- **Financial barriers include several critical ones**, again quite similarly as in the previous chapter on co-operative housing. High initial costs were deemed critical in our interviews, even though municipalities have greater opportunities for financial subsidies than the private sector (Karasek and Ubralova 2012), but overall municipal budgets are small. Moreover, there is often a lack of convergence between the municipal budget and the retrofitting schedule: budgets need to be drawn up before the potential financial subsidy is approved and hence it is often difficult for the municipality to estimate project costs. A similar problem is access to capital, which depends on the availability of state or European financial sources.
- **Organizational problems** include the landlord-tenant dilemma – this is particularly critical for municipal rental housing as older buildings are frequently rent-controlled, which makes it difficult to transfer the costs of the renovation into the rent (Karasek and Ubralova 2012). However, rent control is being gradually disbanded (CECODHAS 2012b). Collective decision problems here refer to the difficulties of prioritizing municipal budget items, as there are always several projects that need investment, and compete for allocations from the municipal budget. According to Karasek and Ubralova (2012), usually the buildings that are in the worst condition are renovated first. Municipalities also need to balance their budgets on an annual basis. Moreover, municipal elections create a relatively short time-frame for decisions (Jezek et al. 2004).

- **Lack of information and skills:** Lack of customer knowledge and unsophisticated financial analysis are critical barriers, especially for small municipalities.
- **Transaction costs** play a similar role in municipally owned rental apartments as they do in the other types of apartments discussed in the previous chapters. Critical barriers include the lack of skilled service providers and concerns over disruption (see Karasek and Ubralova 2012).

The main drivers of energy renovations in municipal rental apartments are similar to those in the other apartment building types discussed in the previous chapters. However, the obligation to conduct audits for municipally owned buildings consuming more than 1500 GJ and the requirements concerning energy performance certificates (EPCs) are likely to create stronger environmental or societal pressures and motives.

On the basis of our literature review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria:** Financial criteria are dominant, as municipal budgets are small. Because of this, initial cost is rated as the most important criterion by our experts, whereas payback times and return on investment are slightly less important in decision making.
- **Ease of renovation:** As many of the renovations are made using state grants, municipalities often hire a special agency to arrange the submission of the application; this is relatively straightforward as projects can be planned on the basis of data from energy performance certificates, energy audits and standardized solutions for panel buildings (Karasek and Ubralova 2012). Hence, the availability of turnkey solutions is an important factor influencing decisions, according to our interviews.
- **Lifetime and risk considerations:** Timing, ease of maintenance and the widespread use of the selected solutions have a similar role as in other multi-apartment buildings.
- **Other criteria:** Improved comfort has an intermediate role, according to our interview. Improved value of the property and social approval or status do not factor into decisions, even though improving the appearance of buildings may be important for residents (Karasek and Ubralova 2012).
- **Environmental and social motives or pressures** do not have a large role. They are rated similarly as for other types of multi-family housing. However, our interviewees suggested that recommendations by experts can be important in the public sector.

6.3.5 Public buildings

Public buildings in the Czech Republic amount to about 10% of the total floor area. Most of public buildings are owned by the municipalities. Only buildings of state organizations and government are owned direct by the state. Typically public facilities are owned by municipalities. Army facilities are owned by the state.

Municipalities have a large number of mandatory responsibilities in the Czech Republic, including the maintenance of local streets and roads; primary education; social services, including care for the elderly and the disabled; primary healthcare, and public safety (Lacina and Wajdova 2002). There are also a large number of municipalities with independent budgets in the Czech Republic (6,244 in 2002); while budgets should be balanced, several smaller municipalities are becoming indebted (Lacina and Wajdova 2002). However, municipalities are encouraged by the state to make energy renovations, e.g. by the mandatory energy audits (see below) and a specific loan programme for the modernization of housing units (MURE database 2006).

One particular issue in the case of municipally owned buildings relates to the rules and criteria for public procurement. According to our interviews, cheapest price is often the main or only procurement criterion. Long-term operational costs are not taken into account. One interviewee suggested that more ambitious rules would facilitate better energy investments: for example, if the bidding price were fixed and the most energy efficient solution would be selected as the winner.

The most important barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost effectiveness:** Conflicting information is a similar barrier for the public sector as for other building owners, according to our interviews. Uncertainty concerning measurement and verification of energy saving is another barrier that is rated as critical, considering eg. tenant behavior, amount and temperature of heated space. This also makes third-party finance (e.g. EPC) difficult.
- Among **financial barriers**, high initial cost is rated as critical. The importance of initial costs is supported by the relative success of EPCs, ESCOs, and other forms of third-party financing in public buildings in the Czech Republic (Lamers et al. 2008). There are several schemes in the Czech Republic that offer finance for energy investments by municipalities (Rezessy and Bertoldi 2010), but programmes are currently closed for new applications. Hence, access to capital was rated as a critical barrier by our experts.
- **Organizational problems** include two barriers that are rated critical. The landlord dilemma is rated as critical, as decisions are made by a higher level of organization than the one that pays the heating costs. Collective decision problems and public budgeting practices here refer to the difficulties of prioritizing municipal budget items, as several well-justified projects compete for funding in public budgets.
- **Lack of information and skills:** Lack of information and attention is not considered critical in our interviews – there are many pressures today for public sector building owners to monitor and reduce their energy consumption. However, lack of customer knowledge is rated as critical, mainly for small municipalities.
- **Transaction costs:** According to our literature and the expert opinions gained, these are not the main barriers for the public sector, which usually has market power and the capacity to gain information and expertise.

Energy cost savings are naturally an important driver; moreover, public building owners (larger municipalities) are likely to command a better knowledge of renovation needs than other building owners. This is because energy audits are compulsory for public bodies consuming more than 1500 GJ per year. This provides a base of information on energy use and recommendations for measures to improve energy efficiency (MURE 2006). Other drivers include grants and loans available for municipalities to improve their building stock (Sochor 2010).

On the basis of our literature review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are the most important decision criteria for municipalities. Low initial costs are motivating in themselves, and several types of subsidy programmes (sometimes combined with EPC) can serve to reduce these costs significantly (Sochor 2010). In public administration, low initial costs can also make decision making about projects easier administratively and politically. Payback times and returns on investment were deemed less important decision criteria for municipalities.
- **Ease of renovation** is a somewhat less important group of decision criteria. However, the availability of turnkey solutions or full-service packages (often including project and finance development) can be an important criterion for energy renovations (Sochor 2010; Karasek and Ubralova 2012, interview data).
- **Lifetime and risk considerations** carry a medium weight. Timing in relation to previous renovations is less important than the availability of financial resources, according to our experts. However, our interviews suggest that ease of maintenance plays a relatively significant role in energy renovations in public buildings.
- **Other criteria** such as improved comfort and improved value of property were not deemed important criteria.

- **Environmental and societal motives** have a medium weight as decision criteria for the public sector. However, our interviews suggest that recommendations by experts play a relatively important role in the public sector.

6.3.6 Office buildings

Office buildings amount to a total about 9% of the total floor area. Of this, about half is estimated as being owner-occupied and about half rental office space. Especially Prague has experienced significant development of new and refurbished office space by professional developers (Sýkora 2007). However, according to Sýkora (2007), most of this office development is new build, or in the case of refurbishment, often the conversion of buildings from other purposes.

Office buildings in the Czech Republic can be roughly categorized into three main groups according to construction style in relation to the time of building (Lain et al. 2004): The oldest buildings are of massive construction, the newest ones are modern office buildings, whereas the most common type of office buildings (1950s-1980s) have a heavy concrete frame and floors and light prefabricated envelope, with no mechanical ventilation. This last aspect can be a driver for renovation, as ICT equipment requires greater amounts of cooling. Until now, there has not been significant regulatory or customer pressure to include energy improvements in office building renovations, but the situation is changing due to EPBD2.

The most important barriers to energy renovations can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** include one critical barrier: interviewees mentioned conflicting information as a major barrier for all types of building owners.
- **Financial barriers:** High initial costs and long payback times are all rated as critical barriers. While companies usually have easier access to capital than households or municipalities and make investment decisions regularly, energy improvement and renovations need to compete with other investment options (e.g. productive investments that support the growth of the business).
- **Organizational problems** were not raised as major problems in our interview.
- **Lack of information and skills:** Interest in the energy consumption of office space is a fairly recent phenomenon in the Czech Republic. Lack of customer attention and interest and lack of customer knowledge were highlighted as major barriers in our interview.
- **Transaction costs** are rated similarly for office building owners as for the other building owner types: these were not highlighted as the most critical barriers.

Recently, the marketing advantage of green buildings has emerged as a new driver for energy renovations. Moreover, some individual office owners, such as the large bank, CSOB, have built high-profile 'green' office buildings and one-third of the environmentally certified office space in Central Europe is located in Prague (Cieniski 2012). This development is expected to have an impact on other professional office space owners, as buildings may be easier to rent or sell when they have environmental certification. However, green office developments are still a minority and the value of office space depends significantly on its location.

On the basis of our literature review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** dominate, as the office building owners considered here are usually companies, which aim to conduct their business in a financially profitable way. Compared to the previously mentioned owner categories, more sophisticated measures such as payback time and return on investment are likely to have a larger role, in particular for professional office space developers.
- **Ease of renovation** can be important, as time is money for businesses. Hence, the quality of services and the availability of turnkey solutions have a relatively large role, and quick installation is very important.

- **Lifetime and risk considerations** have a somewhat lesser role. Office buildings have renovation schedules, hence timing is important, whereas, ease of maintenance and the availability of widely used solutions are likely to have a slightly lesser role as decision criteria.
- **Other criteria** can also have a financial angle to them in the case of professionally owned office space, and issues of comfort, appearance and value of the property can also have financial (intangible) value for office owner-occupiers. Hence, these criteria have a relatively important role, and social status, which also has a financial aspect, can have medium importance for office occupants.
- **Environmental and societal motives and pressures** influence different companies differently. Larger companies are concerned about their public image and corporate social responsibility, and are thus more likely to respond to environmental pressures. Energy renovations can be a cost-effective way to do so. On average, however, environmental considerations, expected future regulations and recommendations by experts are rated as having a medium role at best.

6.4 Discussion on barriers and drivers of energy renovations

There has been an increasing emphasis on energy renovations in the Czech Republic in recent years. This is due to increasing awareness created by European directives and financial instruments, as well as to activity by energy auditors, architects, engineers, state institutions, universities and civil society. However, since the building stock is old and still largely in a poor condition, there is much work ahead.

Table 6.2 presents an overview of the barriers identified in our literature review and expert interviews. Barriers shared by all owner groups in the Czech Republic seem to be problems with conflicting information and mistrust of information. This appears to be a situation typical in situations where markets for energy efficient solutions are rapidly expanding, and there are many players offering their own solutions. Other widely shared barriers are the high initial cost of energy efficient solutions and limited access to capital or the high cost of capital.

Where there are several owners, organizational problems are also widespread. These include especially collective decision problems: while the owner-occupied sector is not so large, the co-operative rental apartments in the Czech Republic are similar to owner-occupied ones as the owner-occupants have the final say on energy investments. Collective decision problems are also perceived to be widespread in public sector organizations, where there are several decision makers at various levels. Lack of customer knowledge – especially knowledge about solutions that are appropriate to their situation - was also deemed a widespread problem by all our interviewees. Transaction costs influence different building owners differently: they are most severe for the owner-occupied apartment buildings which are relatively small contracting units. Disruption in general seems to be a larger problem in apartment buildings than in single-family homes. This is probably because individual residents can block decisions, and e.g. elderly people are often more affected by disruption.

Our interviewees have several suggestions for how to overcome these barriers and further stimulate energy renovations. While there is information available, it requires some expertise to use: hence, an intelligible information campaign and public support for gaining high-quality energy performance certificates were suggested as useful informative instruments. Subsidized energy audits with expert recommendations were suggested as a way to overcome informational barriers. It was also suggested that loan subsidies should be offered for renovations that make a significant impact on energy for better renovations. In the public sector, a revision of public procurement rules was considered important in order to focus attention on lifetime costs rather than the companies offering the lowest initial cost.

Table 6.2 Most widespread and critical barriers among different building owner groups. Barriers rated critical are indicated in red and less critical ones in orange.

	single-family homes	owner-occupied apartments	co-operative apartments	municipal rental apartments	public buildings	office buildings
Genuine uncertainties regarding cost effectiveness						
Conflicting information, mistrust of information						
Heterogeneous outcomes						
Uncertainty in measurement/verification of savings						
Financial barriers						
High initial costs						
Long payback time						
Access to/cost of capital						
Unwillingness to incur debt						
Occupant take-back						
Low/uncertain resale value of property						
Organizational problems						
Landlord-tenant dilemma						
Collective decision problems						
Short timeframe of decisions						
Public budgeting practices						
Lack of information and skills						
Lack of customer attention and interest						
Lack of customer knowledge						
Lack of reliable advice						
Unsophisticated financial analysis						
Transaction costs						
Lack of skilled service providers						
High information search costs						
Switching costs, concerns over disruption						
Risks of failures in renovation						

Source: interviews and literature as presented above.

In spite of these barriers, there are several drivers for energy renovations. Especially, the success of the recent Green Light for Savings programme, also in creating awareness, has been emphasized (Zámečník & Hlaváč 2012). Several parties have an influence on building owners' propensity to make energy renovations:

- **The state and local government:** The two major subsidy programmes have had a large influence on renovations: The Panel program resulted in more than 300 000 renovations of flats and the Green Light for Savings programme raised significant interest (Zámečník & Hlaváč 2012). Moreover, the ongoing EPBD2 developments have attracted a lot of interest.
- **Energy auditors:** Audits are mandatory for all buildings receiving a state subsidy within the National Panel Programme, as well as for buildings owned by the public sector if their energy consumption is more than 1500 GJ/a (MURE database 2006).
- **Architects and engineers:** There is an increasing emphasis on training architects and engineers in energy efficiency (Hajek and Tywoniak 2007). Universities, in general, have had an important role.
- **Banks:** Banks have had a central role, e.g., in administering the Green Light for Savings programme (Zámečník & Hlaváč 2012).
- **Civil society: In the Czech context,** individual citizens are often highlighted as forerunners, and examples from neighbouring Austria are presented as inspiration.
- **Companies offering solutions:** It seems that different players in the renovation industry have somewhat different views on what are sensible solutions. Some new companies are eager to offer comprehensive packages of solutions, whereas traditional players in the industry are more conservative?

Table 6.3 presents a summary of the decision criteria identified in our study as important for different building owner groups in the Czech Republic. As concerns decision criteria, initial cost was the one criterion that all owner groups commonly considered to be important, according to our data and the views expressed by the interviewees. There is less emphasis on other financial criteria, except for among office building owners.

In contrast to many other countries, the timing vis-à-vis previous renovations did not seem to play a big role among building owners in the Czech Republic. In other respects, there are differences among owner groups. Our interviewees did not place much emphasis on the importance of widely used solutions; however, the availability of standard solutions was stressed in the literature, especially for the panel buildings. Hence, this criterion might have an important role in some cases.

Owner-occupants and rental co-operative owner-occupants appear to value improved comfort highly (though there is some ambiguity here concerning owner-occupied apartments). For larger building stock owners, such as rental housing, public buildings and office buildings, the availability of turnkey solutions seems to be an important criterion for larger building stock owners. Unlike many other countries, expert recommendations also appear to play a fairly important role in the public sector in the Czech Republic.

Table 6.3 Most important decision criteria for the major owner groups.

Criteria	single-family homes	owner-occupied apartment buildings	co-operatives	municipal rental	public buildings	office buildings
Financial						
Initial cost						
Payback time						
Return on investment						
Ease of renovation						
Quality service available						
Quick installation						
Turnkey solutions available						
Lifetime and risk considerations						
Timing vis-a-vis previous renovations						
Ease of maintenance						
Widely used solution	?	?	?	?		
Other benefits						
Improved comfort		?				
Improved value of property						
Social approval/status						
Environmental/societal motives/pressures						
Environmental considerations						
Expected future regulation						
Recommendation by experts						

Source: interviews and literature as presented above.

7. Finland

7.1 General overview

The Finnish building stock is relatively new. More than 40% of all buildings in Finland were built after 1980 (Ministry of Environment 2007). Hence, many of the current buildings have been influenced by the energy performance standards introduced during the energy crises. Energy performance standards for major building components (U values) were significantly tightened in 1976 and requirements for airtightness (n-50 specification) were introduced, and the U values were tightened in 1978 and 1985¹¹. Small revisions were made again in 2003 and 2007 and major revisions in 2010. The same standards apply to all building types.

Since 1983, the energy efficiency of buildings has been the responsibility of the Ministry of Environment, which gives detailed regulations and instructions in the National Building Code. The Building Code sets a minimum level for energy efficiency for *new* buildings and building permits are awarded by the municipal building supervision authority. Recently, a draft decree on energy efficiency standards for *existing* buildings has been sent out for comments. The plan is to approve the decree in early 2013.

A large share of the building stock is approaching the age for major renovations. However, markets for renovation services have only recently started to develop to meet this need. There are also several other targets than energy efficiency in the national renovation strategy (Ministry of Environment 2007): mould and indoor air quality problems need to be solved and buildings need to be made more accessible for an ageing population.

Moreover, problems and opportunities are very different in different parts of the country. People continue to move to growing regions, mainly in the south of Finland, whereas especially apartments and public buildings in other parts of the country are becoming redundant (Ministry of Environment 2007; 2009). This large mobility is also reflected in the value of buildings. For example, in summer 2012 the cost/m² for apartments was double in the metropolitan area compared to other parts of the country. This can be a challenge for making renovations outside the metropolitan area: the cost of renovating is approximately the same, but the value of housing is determined according to location.

Several measures to stimulate energy renovations have been introduced during the past decades. These include financial incentives (see below for more measures pertaining to different types of buildings) and the provision of training and advice. The national strategy for renovation (Ministry of the Environment 2007) has launched initiatives to improve competencies and markets for renovations (Ministry of the Environment 2009). The Energy Performance Certificate also seems to be gaining importance in stimulating renovations. Until now, they have been voluntary for old single-family houses and houses with less than six dwellings. They are to become compulsory when these buildings and certificates will be required to include recommendations. According to a survey to facilities professionals by Motiva (2009), two-thirds of the energy performance certificates in the study had included recommendations, and 17% of these had already been implemented.

Table 7.1 presents an overview of the owners and decision makers by building type. The major owner types, their decision structures and main barriers and drivers are then presented in the next section. Major refers here to categories that have a large share of the floor area and share distinct characteristics. This has also involved some regrouping of owner types, which is explained in detail below.

¹¹ For example, the Building Code of 1978 requires the following U-values: exterior walls 0.29, roof 0.23, base floor 0.40, windows 2.1, doors 0.7. The airtightness requirement (n50) was 6.

Table 7.1. Major owners and decision makers for residential, public and office buildings

Building and owner type	Share of total building area, %	Decision makers and types of owners
Single-family detached		
Owner-occupied	33,9	Owners individually: private households
Rented	1,0	Owners individually (mainly private households)
Single-family attached		
Owner-occupied	5,2	Owners collectively: General assembly of the housing owners. Decisions prepared by board and house manager.
Rented	2,2	Owners: private persons, municipalities, etc.
Apartment buildings		
Owner-occupied	10,2	Owners collectively: General assembly of the housing owners. Decisions prepared by board and house manager.
Private rental	5,3	Private persons (making decisions together with owner-occupiers), companies, non-profit companies
Social rental	5,2	Owners: Non-profit companies, municipalities
Public buildings		
State	2,3	Senate Properties (owner of most of the building stock)
Local government	7,9	Municipalities at various levels, or via centralized unit
Commercial office buildings		
Owner-occupied	4,3	Companies using buildings (e.g. corporate headquarters)
Rental	3,9	Professional property management companies, portfolio investors
Other	18,6	
Total	100	

Source: Statistics Finland

7.2 Barriers and drivers of energy renovations among major building owner groups

7.2.1 Owner-occupied single-family houses

Owner-occupied detached single-family houses are the largest building type in terms of total building area in Finland, amounting to almost 34% of the total floor space in m². Most detached single-family houses are owner-occupied¹². This means that the owners make decisions concerning the renovation of their buildings on their own. They can only be influenced legally by the municipality, and this mainly in case of public hazards or nuisance or solutions that require a permit. At present, they are cannot however be legally required to make a renovation.

There is a grant scheme in Finland to promote a shift to renewable heating systems in detached single-family homes. This is managed by the Housing Finance and Development Centre of Finland (ARA) on the basis of annual allocations from the government budget and handed out and monitored by the municipalities¹³. Decisions by owners of detached single-family homes are also influenced by information.

¹² Rented detached single-family houses are usually owned by private persons, and sometimes by municipalities. They are a small and heterogeneous share of the total building stock (1%), and there is little information available on this building category. They are not dealt with separately in this report.

¹³ In 2012, grants are awarded for ground-source heat, air-water source heat pumps, pellet and woodchip burners, wood-based central heating, and hybrid systems including solar heat and power. Grants are only available for existing buildings and recipients

Municipalities offer information via building inspectors and local renovation advisors. The Finnish Homeowners' Association and its local chapters offer energy advice and organize energy evenings. However, in terms of volume, the largest amount of information is offered by commercial service providers. Especially companies marketing heat pumps have been very active in their marketing.

In terms of demographics, detached home owners are usually older than average. The typical homeowner household has at least one person aged 45-74, and 43% of this age group lives in a detached house (Statistics Finland 2010). However, homeowners are not homogeneous, but include younger and wealthier households in or near cities, and older and less wealthy households in more rural areas (Ahlqvist 2004).

New heating systems are the most cost-effective type of energy renovation for single-family homes (Rinne 2009). These are usually not connected to the district heating network, but are heated with electricity or oil. However, some homeowners are still hesitant even about these measures. Other renovations, apart from extra roof insulation and ventilation heat recovery in some cases, are usually not very cost-effective unless connected to an ongoing renovation (Rinne 2009; Häkkinen et al. 2012, Heljo and Vihola 2012).

The main barriers to energy renovations in owner-occupied single-family homes can be summarized as follows:

- In terms of **genuine uncertainties regarding cost-effectiveness**, conflicting information is the greatest barrier (Haavik 2010; Heiskanen and Lovio 2010). This is partly due to genuinely heterogeneous outcomes: the effectiveness of measures in a particular building depends on many different factors. However, uncertainty concerning measurement and verification are usually not a major concern, as homeowners rarely calculate at this level of detail.
- **Financial barriers** are important for almost all homeowners, although they are naturally more severe for some than others. However, even fairly wealthy people are used to calculating payback times for energy investments, even though they make other investments of a similar size (e.g., buying a car) without such calculations. Long payback periods are a concern particularly for elderly people, who cannot expect to benefit from their investment during their lifetime at home. For the less wealthy, initial costs are critical (Paiho et al. 2012). Access to capital is a critical problem that is not completely explained on rational grounds. Homeowners can usually get a loan for energy improvements, but many might not know this or are unwilling to have dealings with banks (Heiskanen et al. 2012). The resale value of properties is particularly critical for homes outside the metropolitan area, or small homes that are not up to "modern standards".
- **Organizational problems** are not relevant for detached home owners, apart from the short time frame. However, elderly owners may want to involve their adult children in decisions, as they will inherit the house, but many are not (understandably) eager to broach the subject (Heiskanen et al. 2012).
- **Lack of knowledge and skills:** Lack of attention is not a relevant barrier, as only the very richest are oblivious to energy costs today. However, in terms of knowledge levels, detached home owners are a heterogeneous group. While there is much knowledge available, most home owners may have difficulties in selecting reliable knowledge and applying it to their own home. Lack of knowledge and skills is thus rated as a critical barrier, as are lack of reliable advice and lack of sophisticated financial analysis. In this respect, the situation has improved in recent years.
- **Transaction costs** include two critical barriers. The lack of skilled service providers is something of a problem (Syvänen and Mikkonen 2011), as the quality of renovation can be variable and difficult to judge in advance. High information search costs are a major problem: there are many options available, and finding the right one can take time and effort (Heiskanen and Lovio 2010). Switching costs and risks of failures are deemed lesser barriers. Switching and disruption can be quite severe

can receive 20% of the investment costs. A total of 10 million € are allocated for renewable heating systems. The grant can be combined with a general tax deduction from work conducted in the household, which can be used for installment and e.g. drilling of boreholes for groundsource heat. The maximum amount of the tax deduction in 2012 is 2000 € per person. In addition, grants are also available for other energy efficiency investments by low-income households.

problems, however, for older home owners. Risks of failure can also frighten the more sensitive people, as failed renovations and e.g. mold problems gain plenty of attention in the media.

- An additional problem is **high seller liability**. The current consumer protection legislation allows buyers of a house to litigate against the former owners even concerning problems that the seller was not aware of. While actual litigation is not common, media reports have frightened some owners of older buildings so much that they prefer to sell their homes “for demolition” in order to avoid liabilities. This situation (even if largely based on false perceptions) does not encourage people to renovate old houses.

There are, however, also several drivers for energy renovations. Cost savings and improved comfort are the major drivers (Paiho et al. 2012). Major driving factors seem to be the rising cost of energy and the heightened public discussion on, e.g., new heating systems. This is reflected, for example in the fact that air-to-air heat pumps have become extremely popular in Finland— largely because the investment costs are low and they are easy to access (Heiskanen et al. 2011). Grants are also popular and several homeowners have made use of the opportunity to deduct a certain amount of the renovation costs from their taxes (Omakotiliitto 2012).

According to a survey conducted by the Finnish Homeowners’ Association (N= 1000 association members), homeowners used about 7000 eur in 2009 for renovations (Omakotiliitto 2012). More than 90% have made some kinds of renovations in 2009 or 2010. The most common renovations were made on roofs and kitchens. Heating system upgrades were the third-most common renovation – on average, 4150 eur were spent on heating systems. Window and door renovation as well as improvements to the building envelope were also made. However, it is doubtful whether these figures describe the average homeowner: probably the more active and renovation-prone are members of the association and respond to such surveys (Vainio 2011a).

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are rated as the most important. Large investments like renovations require some kind of investment calculus. Ordinary homeowners usually use simple payback periods. Their payback expectations depend on their financial and life situation, and can range from 5-15 years. For some homeowners, the initial cost is clearly relevant, as reflected for example in the wide popularity of (very cheap) air-to-air heat pumps (Heiskanen et al. 2011). In contrast, few homeowners use sophisticated methods such as return on investment.
- **Ease of renovation** can be relevant for some homeowners. However, many Finns are still quite eager to do or at least organize things themselves (see Heiskanen and Lovio 2010; Paiho et al. 2012). Elderly people and wealthy homeowners can value ease of renovations and turnkey solutions, and the availability of quality service is somewhat important for all.
- **Lifetime and risk considerations** are important for homeowners. The single most important factor driving renovations is timing (Havik et al. 2010), i.e., the technical need to repair or renew some part of the building. Ease of maintenance can be important for some building components such as heating or ventilation systems. Also, widely used solutions are favoured and the availability of practical, real-life examples is important (Heiskanen and Lovio 2010).
- **Other benefits** can be important drivers for energy renovations (Havik et al. 2010). Improved comfort is relevant especially for more affluent people. For example, air-to-air heat pumps are purchased both for energy saving and for cooling opportunities (Juntunen 2012). Improved value of property can also be a driver in some cases (but as mentioned previously, resale values in many areas are uncertain at best). Social approval or status is usually not mentioned as an important motivator by Finns, but people do tend to follow the example of their neighbours, i.e., social proof (Heiskanen et al. 2011).
- **Environmental considerations** do not appear to be the determining factor in renovations (Havik et al. 2010), though they may carry some weight among otherwise equal alternatives (e.g. often used to justify investment in a ground-source heat pump, which is also cost-effective). However,

according to our experience, expected future regulations and e.g. expectations of rising energy prices can be important arguments, as are recommendations by experts.

7.2.2 Owner-occupied apartment buildings and attached houses

Owner-occupied attached (single-family) houses and apartment buildings share the same legal decision-making structures in Finland, so they are here discussed together. Owner-occupied apartments make up 10,2% of the total building floor area and owner-occupied attached houses make up about 5,2% of the building area. Moreover, there are about 200 000 rental dwellings that are owned by private persons (Vuokranantajat 2008) (about 2,8% of total floor area); these are usually individual dwellings located in apartment buildings and the owners make decisions together with owner-occupiers. Hence, the total share of this compound group of decision makers out of the total floor area is about 18,2%.

Owner-occupied apartment buildings and attached houses are owned by housing companies¹⁴, i.e., the owners own shares giving them right to a certain dwelling or dwellings in the building, in which they usually live themselves (but can and often do also rent). Owners make decisions about the building collectively, in the residents' general assembly, and decisions are prepared and legal responsibility is borne by the residents' board elected by this assembly. The housing company is responsible for the maintenance of building structures and insulation, as well as for heating, electricity, data communications, water, sewage and ventilation systems (Housing Companies Act 2010). The Housing Companies Act also requires housing companies to make long-term renovation plans, which is expected to facilitate the financing of major renovations. Operative management is the responsibility of the house manager; these are today usually contracted professional companies. In housing companies, heating and hot water costs are almost always shared by all residents, as central heating systems are predominant. These costs are covered by a monthly charge, which is usually based on floor area (or number of residents for hot water), *not* on actual or calculated heat use. Hence, most owner-occupiers are not aware of their annual heating and hot water costs, unless they carefully examine the housing company's annual report.

There is a separate grant scheme for buildings with more than 3 dwellings (i.e. attached houses and apartment buildings). Grants are awarded for conducting energy audits, for external repair work as defined in legislation, for improving the ventilation and heating systems, and for implementing renewable energy sources. The grant covers 40% of the actual costs of the audit and 10-15% of the other measures and 20% of certain renewable heating measures. Grants are awarded by the local authority and the scheme is coordinated by ARA, the Housing Development Fund. In 2012, 6,8 MEUR were budgeted for this grant.

Differences between apartment buildings and attached houses relate to scale: attached housing companies are smaller and less professionally managed than apartment buildings; on the other hand, residents are usually more involved in decisions, as many are members of the residents' board. Another difference relates to heating systems: slightly less than half of the attached houses in Finland are connected to district heat; other dominant heating sources are electricity and oil. In contrast, 87% of apartment buildings are heated with district heat (Statistics Finland 2012). This makes a difference for the cost-effectiveness of renovations: district heat costs less than 7 cents/kWh; heating electricity almost 13 cents/kWh and oil about 11 cents/kWh (Statistics Finland 2012). Heating systems changes are hence fairly cost-effective for houses that are not connected to district heat, and other renovations are also more cost-effective than in houses with district heat, if all other factors are equal.

In terms of demographics, apartment owner-occupiers are older than tenants. Apartment owner-occupancy is the most common housing form for the most elderly households (oldest member aged 75 or more). Families living in owner-occupied apartments are less wealthy than families living in detached houses (Ahlqvist 2004). Attached houses are common in small-town centres and the suburbs of cities. In

¹⁴ Rented attached single-family houses are usually owned by municipalities, but could also be owned by private persons or foundations. They make up 2,2% of the share of buildings. As a small and heterogeneous share of the building stock, they are not discussed separately. The observations pertaining to social housing or private rented housing (section 8) apply to this building category, as well.

cities, attached houses are usually owned by families with children, whereas in more rural areas, attached houses are often rented or owned by elderly people (Manninen and Hirvonen 2004).

The main barriers to energy renovations in owner-occupied multi-family and attached buildings can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness:** Compared to single-family houses, attached houses or apartment houses have more resources to collect information and designated people (residents' board, house manager) who are responsible for doing so. However, there is still a lot of conflicting information circulating and some residents mistrust the house manager. Heterogeneous outcomes are a concern, as savings cannot be guaranteed (especially if the energy renovation is linked to another renovation that increases energy use, e.g. ventilation). Hence, it may also be difficult to measure and verify savings.
- **Financial barriers:** Access to finance is not so much a problem for most housing companies as it is for single-family houses, even though 30% of housing companies mentioned financial problems as a reason for not renovating (Vainio et al. 2002). There are several options to finance renovations. Usually, the housing company takes a loan, but recent changes in legislation also help companies to save up for renovations. Residents can also take out an individual loan and pay for their share of the renovation up front. On the other hand, many apartment buildings are currently forced to renovate their pipes, and this may place such a burden on residents that other renovations will not be considered for some time. In general, long payback periods are a problem as major renovations usually lead to significant raises in the maintenance charge. The costs of renovations are a problem especially for pensioners with low incomes and savings (KIRA 2012). According to a survey by the Finnish Real Estate Federation to residents' board members (N=949) and house managers (N=192), the average maximum acceptable payback period was 9 years. Low or uncertain resale values are definitely a problem for owner-occupied apartments and attached houses, especially outside the metropolitan area. The costs of renovations are not easily captured in resale values (Nikola 2011).
- **Organizational problems** are the most critical barriers for owner-occupied apartment buildings, and to some extent, also attached houses (Vainio 2011a). Decisions on renovations require the agreement of the majority of residents. It is very difficult to make collective decisions, especially if residents have conflicting interests. Many residents are not well informed and fail to attend annual residents' general assemblies. Preparing decisions can take years (Korhonen et al. 2005; Huhtanen 2011). The short time-frame of decisions can also be a problem. Elderly residents are usually not eager to renovate (Vainio et al. 2002; Korhonen et al. 2005). Finns also move fairly often and sell their apartments (Nikola 2011).
- **Lack of information and skills:** In terms of lack of attention and interest, the situation within housing companies is mixed. The Housing Companies Act (2010) obliges the residents' board to make an annual review of renovation needs and presents it at the residents' general assembly. Existing data suggest that residents' boards are increasingly aware of their responsibilities in good energy management and upkeep of the building (Nupponen 2010). However, many 'ordinary' residents are not aware of their responsibilities as owners and have other concerns, such as family, work or illness (Korhonen et al. 2005). House managers are increasingly also aware of their responsibilities and opportunities in providing services related to energy and renovations; however, they usually have a few hours per month for each building and several other responsibilities – hence, the actual amount of attention is usually limited (Huhtanen 2010; Kyrö et al. 2012). Lack of customer knowledge and lack of reliable advice are severe problems (Ministry of Environment 2007). Modern buildings are complex technical systems and old buildings are idiosyncratic. Finding reliable information that applies to their particular building is a large job for the residents' board members (alongside their other responsibilities and daytime jobs). However, building energy certificates (in the future, always with recommendations) and subsidized energy audits today offer residents' boards background for planning. The next step is more difficult: Finns are fairly unwilling to pay for planning services, reliable advice is usually not available for free, and e.g. grants are not available for planning. According to our interviewees, especially small attached housing companies

rarely have renovation needs evaluated by professionals. The level of sophistication of financial accounting is also usually low: simple payback times are what residents are likely to understand and use in the final decision making.

- **Transaction costs** are a serious problem, because it is not obvious from the outset that every kind of energy renovation will be cost effective. As non-professionals, residents' board members have a difficult time in contracting and planning renovation work and evaluating bids. More than 90% of residents are satisfied with the outcome of their renovation, but one-third of all apartments experienced problems during the renovation phase, especially as concerns co-operation with contractors and the renovation process (Vainio 2011b). While most renovations are successful, ordinary residents are concerned about risks and delays. According to our interviewees, the quality of renovation work (results and process) is often not good.

When considering the drivers of energy renovations in owner-occupied attached houses and (especially) apartments, it is necessary to keep in mind the somewhat different positions of resident's board members, house managers and 'ordinary' residents. It is also important to keep in mind that housing companies in different parts of the country are in quite different situations. Also the age and financial situation of residents has an influence: people whose children have moved out, or whose financial situation is improving are more eager to make renovations than e.g. pensioners and families with small children (Korhonen et al. 2005).

The stated preferences of owner-occupiers of some apartment buildings in large cities built in the 1960s-1970s (N=115) suggest that there is interest in improving energy efficiency, as it was rated as the issue that requires the most attention in the future (however, 28% were not able to rate the importance of energy efficiency), just before windows, heating systems and indoor air quality (Suomen Kiinteistöliitto 2011). Another survey by the Finnish Real Estate Federation (2012)¹⁵ suggests that several housing companies are planning energy improvements in their building. While the most common improvements were low-cost things like balancing the radiator network, cleaning the ventilation system and installing new thermostats, about 30% planned to renew their windows, and about 15% planned to install individual hot water meters and/or add insulation to roofs or walls. About 8% were planning to install ventilation heat recovery. The main drivers for this are the increased public discussion on energy issues and the rising (albeit still relatively low) energy costs.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial issues** are relevant for owner-occupied attached and apartment buildings. However, especially for apartment buildings, initial cost is not the key issue as renovations are usually financed with a loan in any case. Nonetheless, payback periods are important both for board members and for ordinary residents, as they influence maintenance charges. The renovations are usually required to be cost-effective. Return on investment is still rarely calculated, however.
- **Ease of renovation** is more important than in single-family homes, as residents expect 'easy living' in an apartment house, and residents' boards have lots of work on their hands. Major renovations are usually contracted to a main contractor, who manages most of the organizing and sub-contracting, but ready full service packages can somewhat ease the process (Vainio 2011b).
- **Timing is critical.** Renovations are made when building parts are reaching the end of their life – rarely any earlier. Also, previous renovations need to be preferably paid off. Ease of maintenance should be an important criterion, but does not seem to be considered a lot. However, widely used solutions are usually preferred over idiosyncratic ones, and experiences are often collected from other houses.
- **Other benefits:** Improved comfort and amenity are important drivers (Korhonen et al. 2005). Improved property values are also frequently voiced arguments, to which status is also linked: Apartments are more often considered investments than single-family homes (Nikola 2012).

¹⁵ survey to residents' board members (N=949) and house managers (N=192)

However, since location is very critical for real estate values in Finland, an individual building cannot improve its status greatly above that of its neighbourhood.

- **Environmental and societal motives and pressures:** Ordinary Finns are also concerned about the environment, but environmental considerations do not seem to feature very highly in final decisions about major energy investments (see Korhonen et al. 2005; Nupponen 2010). Future regulations, however, are taken moderately seriously, and recommendations by experts are highly valued. For example, one of the most important driving factors identified by Korhonen et al. (2005) was the expertise of members of residents' boards (see also Heiskanen 2010).
- **An additional factor** influencing how individual residents vote concerning a renovation is "attachment to the building" (Korhonen et al. 2005; Nupponen 2010). This varies greatly among apartment owners, as people may live in a building for decades or consider it merely a short-term solution or an investment.

7.2.3 Rental apartments: commercial, co-operative and social (professionally managed)

There is not much difference between professionally managed rental apartments, irrespective of whether they are social housing, non-profit or for-profit. The largest difference is between professionally managed rental apartments buildings and individual "investment" apartments owned by private persons (or companies or foundations), which are located in buildings with mainly owner-occupiers. This latter type is discussed above in connection with owner-occupied apartments¹⁶. The following discussion concerns professionally managed rental apartments, which make up about 7,6% of the total floor area.

Private rental apartment make up 5,3% of the total floor space. These are apartments offered without considering the residents' social needs for housing (e.g. no upper income levels). More than half of these apartments are individual apartments in a normal housing company owned and rented out by private persons, companies or foundations, which are discussed above in connection with owner-occupied apartments. However, the rest are professionally managed by e.g. municipalities, foundations, pension funds or corporations. As concerns decision-making and energy renovations, they are fairly similar to the social housing buildings, and are discussed together with them below. **Rental social housing** is distributed on the basis of social need, i.e., income levels and family situation. This type of housing makes up 5,1 % of the total floor area of buildings. The construction of such buildings also gains an interest subsidy from the state. Most of these apartments are owned by municipalities, but some are owned by non-profit companies.

Tenants in Finland do not have a veto on renovations. Nor is there any limit on including renovation costs in the rent. Commercial rental housing has no rent control (although raises of more than 15% have to be justified by renovations that improve the value of the house, and need to be announced six months in advance). Social housing is rent controlled, but actual costs (including investment costs) can be charged in rents once the tenant has been informed two months before the raise in rents. Whether this has an impact in terms of losing tenants depends greatly on the location. In the metropolitan area, there is such a scarcity of rental apartments that tenant loss is highly unlikely, but in other parts of the country, this may be a concern. Especially social housing providers also need to take into account residents' viewpoints and e.g., the concerns of local politicians.

Rental housing is professionally managed. Several organizations such as the Finnish Real Estate Federation, RAKLI (Finnish association of major housing, commercial real estate and infrastructure owners, real estate investors and service providers) and the Building Information Foundation offer expert advice, research and development and other services. Professional building owners have long-term renovation plans and use sophisticated tools to monitor, calculate and estimate energy and other building costs and revenues. The largest rental property owners (23 companies in total) have joined a voluntary agreement coordinated by

¹⁶ However, overall commitment may be lower among absentee landlord owners than owner-occupiers. The landlord-tenant dilemma, however, does not distinguish landlord-owners from owner-occupiers in Finland, as energy costs are not paid for separately by tenants, but part of the rent and shared among owners according to building area.

RAKLI (Rental Organizations' Action Programme) and the Ministry of Employment and Economy and have set targets for energy savings.

Rental apartment houses are usually located in areas served by district heating. This influences the cost-effectiveness of different solutions as district heat is cheap. On the other hand, rental housing, which is professionally managed, has had long-term renovation plans for years. There usually are detailed plans for the renewal of each building component as well as for larger 50-year renovations.

In terms of residents' socio-economic and demographic features, rental apartments (social and commercial) usually house small households. More than 85% of the tenants consist of singles or couples. Tenants are also younger than the average population: about 70% of all households under the age of 30 rented their apartment (Statistics Finland 2010).

The main barriers to energy renovations in professionally owned, rental apartments are presented below:

- **Genuine uncertainties regarding cost-effectiveness:** Because professional housing providers make detailed and sophisticated calculations, they are likely to be more concerned about genuine uncertainties than owner-occupier housing companies. On the other hand, they have more access to information and in-house professional knowledge: hence, uncertainties about solutions or conflicting information are not a major problem. In contrast, heterogeneous outcomes and problems in measurement and verification may be more of an issue, even though many professional housing providers have good measurement systems or are currently building them.
- **Financial barriers** influence professional housing providers differently from non-professionals. Initial costs are not a problem (except for small municipalities), but payback times are examined carefully. Access to capital is usually not a problem for professional housing providers (except for municipalities, with several other competing investments). Occupant take-back is not as much of a problem in Finland as in other countries, as e.g. room temperatures are quite high (21° C) and the standard of living is quite comfortable. However, when energy renovations are made in connection with other improvements (increased ventilation, which is often low in old buildings), heating energy savings may be cancelled by increased airflow and electricity use (Heljo and Vihola 2012).
- **Organizational problems:** Landlord-tenant dilemmas are not so much of a problem in Finland, as tenants do not pay for heating energy according to use but as part of their rent (based on floor area). Hence, any savings gained through energy investments accrue to the building owner. However, even professional housing providers have relatively short time frames for their decisions. Moreover, municipal social housing providers are hampered by public budgeting practices (see more in the section concerning municipalities).
- **Lack of information and skills** are not generally a problem for professional housing managers, even though this may be the case for small municipalities owning a few rental apartments. Large housing providers usually have in-house professionals and access to the newest knowledge. However, for the newest technologies and solutions, expert advice may be difficult to find (Heljo and Vihola 2011).
- **Transaction costs** are not a severe barrier for larger professional rental housing providers, although they may be a severe problem for small social housing owners (municipalities). At least the largest rental housing providers have market power and can find (relatively) good contractors. However, since cost-effectiveness is not so high, internal rates of return can be influenced by small details in prices of solutions. Information search costs can be high even for professionals, especially if the newest solutions (e.g. in heat recovery) are used (Heljo and Vihola 2011). Due to high market power, risks of failure are less than for small customers. Disruption caused by renovations is naturally both an amenity factor for residents and a cost factor for housing providers.
- **An additional barrier** that is not so widely discussed is the complexity of use and maintenance of new energy efficient solutions. They may not save energy if not appropriately controlled and maintained (e.g. heating systems, ventilation systems). The education level of maintenance staff is not very high and turnover is large. Residents are not very motivated to learn about how to use

new building systems (e.g. clean venting outlets). Hence, the potential complexity of systems and the demand for skilled users and operators may be a barrier to some new energy solutions.

As concerns the drivers for energy renovations, professional owners of rental apartments are in diverse situations. Apartments in cities are likely to be renovated to maintain their value, whereas municipally owned social housing outside the larger city-regions are rapidly depreciating in value and usefulness as potential residents move to larger centres. Hence, social housing owners in small municipalities have few incentives to make renovations and may try to sell off their properties if they can. However, most rental housing is located in cities and owned by stable companies or cities with sound finances.

At least the most progressive companies see great opportunities for cost-effectiveness via better energy management (Aromaa and Haverinen-Slaughnessy 2012). Environmental considerations are likely to play quite some role for the larger rental housing owners, which have environmental strategies and management systems and are committed to a voluntary energy efficiency agreement scheme (Aromaa and Haverinen-Slaughnessy 2012). This might even motivate some experiments with solutions that are not currently so cost-effective (like solar PV), but not make them widespread until they become cost-effective. In particular, expectations of future regulations play a large role, as large rental housing providers plan for the long term; costs are easier to accommodate in investment cycles if future regulations are anticipated.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are key, as housing rental is a business or is expected to at least cover its costs. Rental housing is professionally managed, and hence decisions are made on the basis of fairly long-term financial calculations. Initial cost is only relevant for small municipalities (which own only a small share of the total rental housing). Professional rental companies usually use sophisticated investment calculus methods.
- **Ease of renovation** is not a big issue for professional rental housing owners. They have organizational capacities in place to contract renovations. However, there is an increasing interest in 'industrial renovation' which speeds up the time needed for major renovations and thus reduces loss of revenues from rents (Aromaa and Haverinen-Slaughnessy 2012).
- **Timing** is naturally critical and all renovations are carefully timed. Moreover, ease of maintenance is key as maintenance is an important cost factor and professionals know that energy efficient solutions require appropriate maintenance in order to bring the expected savings. This tends to give some bias against new solutions that would require extra training for maintenance companies.
- **Other benefits:** Many professional housing companies take the opportunity to upgrade the quality of their property when conducting necessary renovations. However, improved comfort is not likely as important a criterion for building owners as for residents. Social approval or status should probably not be an important criterion for professionals, but it might nonetheless play a role in upgrading the building stock.
- **Environmental and societal motives and pressures:** Large rental housing companies and municipalities have environmental strategies and energy management systems and monitoring in place; hence, environmental concerns have a medium weight. Future regulations, however, are an important driver, as companies can reduce costs by anticipating them. Experts, on the other hand, can be found in-house, so external expertise is mainly relevant for the newest solutions.

7.2.4 Public buildings

The state (including state-owned companies and universities, which were formerly owned by the state) own a share of about 2,3% of the entire building stock (Heljo and Nippala 2007). Most of this is owned and managed by a state-owned property management company, Senate Properties. It consists of buildings used by the Defence Forces, the Criminal Sanctions Agency, as well as offices and ministry buildings. Senate Properties has committed to reducing electricity and heat consumption in office buildings by 6 % from 2010 levels (Senate Properties 2011). The plan is to increase the use of renewable energy by 9,5% by 2015 and

reduce greenhouse gas emissions by 20% by 2020. It has defined a programme for reducing energy use in 224 of its buildings. At present, most of the properties belong to classes D and E in terms of energy performance certificates. As a state-owned company, Senate Properties is thus highly committed to improving energy efficiency and has the resources to do so.

The Energy Efficiency Directive requires that member states annually renovate 3% of the state-owned buildings to meet at least minimum energy efficiency requirements. Hence, the renovation of state-owned buildings is deemed fairly unproblematic in Finland and not discussed in more detail here. Instead, we focus on municipally owned public buildings.

Municipally owned buildings form the majority of public buildings, and make up 7,9 % of the total building stock. Municipalities in Finland are responsible for healthcare, social services, basic and secondary education as well as technical infrastructure issues and e.g. urban planning. They gain their revenues from income and property taxes and from state subsidies for offering legally required services. Schools are the largest group of buildings, followed by healthcare buildings and residential buildings (discussed above under social housing). Buildings also include industrial buildings, offices, public buildings and sports facilities (Heljo and Nippala 2007).

Management of municipal buildings is organized in different ways in different municipalities (Haakana 2000; Hekkanen 2006). Most municipalities have a separate facility management department (e.g. technical department, facilities centre or company) managing (and also often owning) all facilities, whereas in smaller municipalities, different branches of administration may own and manage their own facilities. Smaller renovations are usually budgeted for in the facility managing department's/company's budget, whereas larger renovations might be funded from the budgets of individual administrations or from a central budget controlled by the facility management department (Haakana 2000). Budgets are usually prepared by the technical board and larger projects approved by the municipal executive board or the municipal council. Higher-level officials and local politicians are important in setting overall targets and guidelines for energy efficiency – and in balancing the overall municipal budget.

Several (71) municipalities have joined a voluntary agreement (Municipal Energy Efficiency Agreement) with the Ministry of Employment and Economy (MoEE), which offers support and requires signatories to e.g. set energy efficiency targets, monitor and conduct energy audits, increase the use of renewable energy and report on achievements annually. The MoEE, in turn, offers discretionary grants for conventional energy renovations to signatories of the agreement (usually max 20-25%), as well as for more innovative projects; ESCO investments and investments in renewable energy to all municipalities. The Association of Finnish Regional and Federal Authorities is an important source of expert advice, in particular for smaller municipalities.

It is important to recognize the diversity of situations in which municipalities are. There are more than 300 municipalities in Finland, almost half of which have less than 5000 residents. Especially the small municipalities struggle to balance budgets, and even renovations that are necessary to maintain the value of properties have been delayed in many municipalities (Heljo and Nippala 2007). Almost one-third of all municipalities (usually small ones) have incurred large debts, whereas about one third have a good solvency ratio (Talouselämä 2012). There are possibilities to get state grants for energy efficiency investments, but only for about 30% of the total investment. The size of a municipality also determines the amount of in-house expertise available: municipalities with less than 5000 inhabitants are unlikely to employ more than one or two in-house building experts.

The main barriers to energy renovations in municipally owned public buildings are presented below:

- **Genuine uncertainties regarding cost-effectiveness** are something of a concern. While there are widely recognized solutions available, there is also disagreement on particular technologies. Heterogeneous outcomes are an important issue – for example, previous studies of school renovations suggest that energy renovations do not necessarily deliver the expected savings (Heljo and Nippala 2007). Uncertainty concerning measurement and verification of savings can be a

problem, e.g., for ESCO contracting, but municipalities that are party to energy efficiency agreements have conducted energy audits and put in place metering and control schemes.

- **Financial barriers** are a problem especially for smaller municipalities. In most municipalities, budgets for building maintenance and renovation have been cut in recent years due to the difficult financial situation. High initial costs in themselves are not critical for most municipalities, although they determine the administrative/political level at which decisions are made and hence also the speed of decision making. Long payback times are, however, important for municipalities, especially smaller ones, as they influence the level of debt. As municipalities have several investment projects underway, renovations will need to compete for capital with other investments (new build, infrastructures, mould problems in buildings). Unwillingness to incur debt depends on the financial situation of the municipality. Occupant take-back is a problem, as well, though take-back can also be due to changes in how the property is used (Heljo and Vihola 2012). Resale values of municipal properties are, in general, highly uncertain and some property may be completely unsellable. In general, small municipalities are also uncertain about their future and hence may be hesitant to make major investments.
- **Organizational problems** depend significantly on how the ownership and management of buildings is organized. This also defines the extent of the landlord-tenant dilemma and the way in which costs and benefits of energy renovations are distributed among building users and the building administration (Haakana 2000). A short time frame for decisions can be a problem for smaller municipalities. Public budgeting practices are definitely a critical barrier, at least in some municipalities (Heljo and Nippala 2007).
- **Lack of information and skills** are mainly problems for smaller municipalities. Hence, lack of (top-level decision makers') attention and interest, lack of customer knowledge and lack of reliable advice are critical barriers for small municipalities. Moreover, unsophisticated financial analysis may be a similar barrier especially for smaller municipalities. In particular, it has been argued that municipalities need tools for assessing life cycle costs and the external costs and benefits of energy renovations (see Heljo and Nippala 2007).
- **Transaction costs** are similarly issues for smaller municipalities. This includes the lack of skilled service providers and high information search costs. A particular problem relates to public tendering practices, which often prioritize costs over quality criteria (Vainio 2011b). Including lifetime costs in public tenders can be quite complicated for small municipalities. However, switching costs and costs of disruption may be problem for all sizes of municipalities, e.g., when entire hospitals or schools need to be relocated. Risks of failure in renovation are not deemed a problem for municipalities, as they employ building inspectors, who hopefully have the time to pay extra attention to renovations in public buildings.

As concern the drivers for energy renovations in municipalities, the decisive factor is top level commitment by politicians and top administrators (Haakana 2000). By 2012, about one-third of all municipalities have drawn up a climate strategy, and most of the regional associations of municipalities have done so (Hakanen 2011). Several municipalities have also set quantitative targets to reduce greenhouse gas emissions ahead of national targets (Savikko 2010; Hakanen 2011). Energy efficiency and buildings are the most frequent areas for specific targets and actions (Savikko 2010; Hakanen 2011). However, the level of commitment in municipalities varies, and most smaller municipalities are occupied with more immediate issues of survival.

Several municipalities have also recognized that investments in energy efficiency can be cost-effective (Hakanen 2011). There have been many projects in recent years to promote systematic renovation and energy issues in municipalities, e.g. through the development of tools for building stock management (Nippala et al. 2006; Heljo and Nippala 2007). Hence, the situation is improving in this respect.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are important, as municipalities use the tax-payers' money. Initial cost should not logically be a very important criterion; however, the (relative) popularity of ESCO funding in

municipalities suggests that initial cost carries some weight, especially as concerns administrative simplicity. Payback times are relevant in regard to uncertainties about the future, but municipalities usually consider the return on investment or the internal rate of return of energy renovations (Heljo and Nippala 2007).

- **Ease of renovation** has a medium weight. Quality services are not necessarily valued so much due to in-house competencies and public tendering practices. Quick installation can play a role due to the need for relocation of users. Turnkey solutions are usually not high on the agenda, either.
- **Lifetime considerations:** Timing vis-à-vis previous renovation is relevant, though timing can also relate to changes in the use of the building (Vainio 2011b). Ease of maintenance should be important, as maintenance problems can often reduce the expected energy saving, but does not seem to have the priority that it should have in practice (Heljo and Nippala 2007). Widely used solutions are likely to be popular especially in smaller municipalities.
- **Other benefits** such as comfort, value of the property and social approval are not likely to have a great importance in decision making, apart from some individual buildings or circumstances. However, health and indoor air quality issues can be major drivers for renovations, which may also then include some energy components.
- **Environmental and societal motives and pressures** are moderately high on the decision making agenda in many municipalities (Savikko 2010; Hakanen 2011), and the public sector is expected to take societal considerations into account and set a good example in environmental issues. Expectations concerning future regulations thus have some importance for decisions, whereas the role of expert recommendations is likely to be larger in smaller than in larger municipalities.

7.2.5 Office buildings

Office buildings amount to about 4% of the total building stock in terms of floor area. A large share of the entire office building stock (apart from public office buildings) is located in or near the metropolitan area. The exact share of rented office buildings (i.e., buildings owned by professional property developers, or at least managed by professional companies) is not known, but it has been continually growing (Vainio 2011b), and likely makes up the majority of the office building stock in terms of floor space. Office buildings may have a shorter lifespan than other types of buildings, and they usually undergo major retrofits at a more rapid pace, as owners try to respond to changes in the business environment.

Rental office buildings are usually professionally managed, and some of the building owners are members of the voluntary energy efficiency agreement scheme for the real estate sector. Professional real estate managers are well linked to the information and development networks of RAKLI, the Finnish Real Estate Federation and some are also involved in the Finnish Green Building Council. While costs are the main driving and constraining factor in professional real estate management, customer's environmental requirements are emerging as another driving factor, in particular in the case of multinational companies as tenants. However, office property owners are probably a diverse group – alongside professional real estate companies there are also portfolio investors such as pension funds as owners. Moreover, outside the metropolitan area and larger cities, office buildings constitute a diverse group of buildings with different forms of ownership.

However, there are great differences among buildings: multinational occupants and professional property developers have a fairly systematic approach to their office buildings (Nousiainen and Junnila 2008), whereas the head offices of smaller companies may not be the main focus of their owners. It is important to recognize that for ordinary office building owner-occupiers, energy costs make up only a few percent of total costs (usually personnel costs dominate), whereas for professional office property managers, energy costs make up about 30% of the cost structure (Halme and Heiskanen 2001).

The main barriers to energy renovations in municipally owned public buildings are presented below:

- **Genuine uncertainties regarding cost-effectiveness** play a certain role, as businesses attempt to make well-informed investment calculi. However, conflicting information is not likely to be a

problem, as companies have the resources to collect information. However, heterogeneous outcomes and uncertainties concerning measurement and verification are major barriers (Häkkinen and Belloni 2011).

- **Financial barriers** include one barrier rated as critical, the long payback time of energy efficient solutions. For example, Häkkinen and Belloni (2011) found that clients value short pay-back times over long-term positive effects, and this is confirmed e.g. in a renovation case study by Oja (2009), where more expensive sustainable solutions were originally considered but later dropped. Payback times are particularly relevant for rental office buildings because user needs can change rapidly, and refurbishment options are always compared with the option to demolish and build a new building (Vainio 2011b; Nousiainen et al. 2006). Other lesser barriers include occupant take-back and uncertainties about how energy investments influence the resale value of the property.
- **Organizational problems** are not a major issue. However, there may be cases of landlord-tenant dilemmas (depending on the type of lease employed) and the short time-frame for decisions may be a problem due to rapid changes in the business environment.
- **Lack of information and skills** are rarely major barriers for office building owners, when compared with other building owner groups. However, the need for tools and methods and dedicated advice is mentioned by Häkkinen and Belloni (2012).
- **Transaction costs** may present barriers to office building owners. Lack of skilled service providers and high information search costs are rated as 'contributory' barriers on the basis of Nousiainen et al. (2006) and Häkkinen and Belloni (2012), where e.g. the lack of concepts for sustainable building refurbishment and integrated solutions were perceived as barriers to energy renovations. Oja (2009) also mentions the lack of commercially competitive products. Switching costs and costs of disruption are likely to be major barriers, and concerns about risks for the overall building performance is rated as a critical barrier (see Häkkinen and Belloni 2012).

Costs and revenues are major drivers for companies; this also applies to energy investments. Costs and revenues have a larger relative impact on professional office space owners, where expectations about higher revenues from office rental can be major drivers (Nousiainen and Junnila 2008; Eichholz et al. 2009). On the other hand, energy efficiency is a cost-effective way for office owners and occupants to implement corporate social responsibility and to project the image of good corporate citizens (Heiskanen 2009).

A study by Nousiainen and Junnila (2008) found that the role of facilities management has grown in corporate environmental management and that many companies considered energy efficiency in business facilities the most important environmental objective. Eco-efficiency criteria and measures have been developed for commercial properties and several building certification systems (e.g. LEED and the Finnish PromiSe) are used in commercial properties (Kaleva et al. 2011). Several professional property owners have joined the voluntary energy efficiency agreement scheme, Action Plan for Commercial Properties, and some are members of the Green Building Council. However, it is worth noting that the lively discussion on energy efficiency in corporate offices includes several agendas: until now, energy efficiency in new build and in operations has gained more attention than refurbishment.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** dominate. However, initial investment costs have a lesser role than payback times (see above), and companies have sophisticated methods to calculate returns on investment.
- **Ease of renovation:** While the particular situation concerning renovations is not known, there is in general a demand for quality services in energy management, especially among owner occupants (Nousiainen et al. 2006). Quick installation can have relevance as time is money in the property business, and turnkey solutions may have relevance for some owner-occupants.
- **Lifetime issues** are highly relevant for office buildings. Timing issues are not only in relation to the previous renovations, but also as concerns the expected useful lifetime of the building and its components (Nousiainen et al. 2006). The importance of ease of maintenance is also better understood, at least among professional property owners, and widely used solutions are favoured

at least by the smaller property owners (Oja 2009). On the other hand, new office buildings have been the first to adopt several technical innovations (Vainio 2011b); hence, owners are not likely to place much weight on widely used solutions.

- **Other benefits** are mainly important for office building owners when they can be quantified in financial terms. Improved value of property is hence likely to be important. While some of the international literature emphasizes the employee productivity effects of office energy efficiency improvements, this does not seem to feature very highly in Finland (see Nousiainen et al. 2006). Social approval (in this case, public image) plays a role but not a very large one.
- **Environmental and societal motives and pressures** depend on the size and operations of the company. However, there are increasing pressures and incentives for all kinds of companies (also offices) to invest in environmental management (Heiskanen et al. 2009). As concerns energy renovations, however, the weight is deemed medium, as there are also cost-effective operational measures that can fulfill most of society's current expectations. However, expectations concerning future regulations and other policy measures are important especially for professional property owners (see Kaleva 2011), whereas recommendations by experts are deemed to have a medium weight (there are several expert networks in this area, but larger property owners also have their in-house expertise and building management strategies).

7.3 Discussion on barriers and drivers of energy renovations

Certain features are common to all or most Finnish building owners. Since the building stock is fairly new and as a rule relatively well-insulated, there are not so many obvious cost-effective opportunities for energy investments in buildings. This is especially the case for buildings that are connected to district heating (most apartment buildings, most public buildings, almost all office buildings), which is relatively cheap due to the widespread use of combined heat and power production.

It is conventional among Finnish building owners – apart from very few exceptional single-family home owners – to always evaluate cost-effectiveness in some way. It is considered the only sensible approach to energy investments (even when other decisions like comfort-improving ones can be made without a cost-benefit analysis). Collective decisions, as in owner-occupied apartment buildings, also require some kind of formal analysis and decision process, which can take several years. While several criteria and issues can be discussed, the final decision is almost always made on financial grounds. The larger and more professional the unit making decisions, the more sophisticated the financial analysis is.

Following from these conditions framing the decision to renovate or invest, the most widely shared barrier is long payback times (Table 7.2). The importance of other barriers, in contrast, depends on the situation of each owner type. Single-family homes are most concerned about high initial costs, access to capital and incurring debt – especially vis-à-vis the value of their property, which may be relatively low outside the metropolitan area. In contrast, collective decision problems are the most severe barrier for owner-occupied apartment buildings. For public buildings and offices, there are major issues related to the financial costs and benefits of competing investments.

There are, of course, differences also within owner groups. Especially for residential buildings, the following issues stand out:

- People are still moving to larger cities and rural areas are declining. The value (indeed the future) of properties in such areas is uncertain at best, and does not easily merit major investments.
- Elderly property owners are not eager to incur debt and especially in case the value of their property is low, they might not be able to get credit even if they want to.
- Some small municipalities are struggling to meet their legal responsibilities. They are not likely to invest in renovations, especially when the future is uncertain.

Table 7.2. Most important barriers to energy renovations for the different owner groups

	Owner-occupied single-family homes	Owner-occupied attached homes and apartment buildings	Rental housing owners	Municipal public buildings	Office buildings
Genuine uncertainties regarding cost effectiveness					
Conflicting information, mistrust of information					
Heterogeneous outcomes					
Uncertainty in measurement & verification of savings					
Financial barriers					
High initial costs				*	
Long payback time					
Access to/cost of capital					
Unwillingness to incur debt				*	
Occupant take-back					
Low/uncertain resale value of property			*	*	
Organizational problems					
Landlord-tenant dilemma					
Collective decision problems					
Short timeframe of decisions	elderly			*	
Public budgeting practices					
Lack of information and skills					
Lack of customer attention and interest			*	*	
Lack of customer knowledge				*	
Lack of reliable advice				*	
Unsophisticated financial analysis				*	
Transaction costs					
Lack of skilled service providers				*	
High information search costs				*	
Switching costs, concerns over disruption				*	
Risks of failures in renovation					

Source: interviews and literature as presented above.

* these are critical barriers for small municipalities, which however own a minority of the building stock.

In spite of these barriers, there are also several drivers for energy renovations. The overall discussion on energy issues has gained significant momentum in the past few years. This has been spurred by rising energy prices (including energy tax increases) and intensified discussion in the media. Several parties can and do influence building owners, including the following:

- **Public bodies:** The state is currently introducing energy performance requirements for renovations, and also offers advice on the korjaustieto.fi portal and on the website of Motiva. Municipalities (building inspectors) also provide advice, though resources are limited. In some parts of the country, local energy agencies have also offered advice and a nation-wide network is currently being established. Grants and tax deductions have a role in stimulating energy investments, especially among single-family home owners.
- **Companies offering solutions:** Facility management companies are important influencers for owner-occupied apartment buildings. Moreover, marketing of energy efficient solutions such as new heating systems has intensified significantly. There are also more and more companies offering comprehensive service packages (e.g. hardware stores offering energy audits, advice and planning), but this is a relatively new development in Finland.
- **Associations of building owners:** There are nation-wide associations for each group of owners: the Finnish Homeowner's Association offers advice for single-family homes, the Finnish Real Estate Federation for owner-occupied apartment buildings, RAKLI for professional building owners and the Association of Finnish Regional and Federal Authorities for municipalities. All of these are active in promoting energy efficient solutions and offering advice. The Building Information Foundation publishes guides and standards (e.g. on renovation cycles), which are widely used at least by managers of larger building stocks.
- **Banks** could play an important role, but do not necessarily actively promote energy efficiency or renewable energy investments today. In autumn 2012, there are only two banks in the country offering a dedicated loan package for energy investments in buildings. Especially concerning comprehensive renovations, our interviewees raised the issue of e.g. short loan periods (10 years) for housing companies, which are not comparable to the payback time of larger renovations.
- **Energy companies** are not yet very active in the field of energy renovations. There is no energy efficiency obligation scheme in Finland, but a voluntary agreement that focuses on informative measures such as electricity consumption reports. A few companies have recently experimented with renewable energy service packages (heat pump leasing, solar PV service).

As concerns decision criteria, there are a few criteria that are highly important for all owner groups (Table 7.4.2). Payback time is a critical issue for all owner types. The more professional building owners of large building stocks also pay attention to the return on investment. Timing is also very important, although the reasons vary slightly. The norm in Finnish building management is to have a maintenance and upgrading plan. Single-family homes usually do not have such a plan, but financial reasons lead to a certain investment cycle. Widely used solutions are also popular: if they are readily available, the decision-making is significantly easier. Recommendations by experts can also be influential, especially if certain solutions are widely endorsed.

Table 7.4.2: Most important decision criteria for the different owner groups

Criteria	Owner-occupied single-family homes	Owner-occupied attached homes and apartment buildings	Rental housing owners	Municipal public buildings	Office buildings
Financial					
Initial cost					
Payback time					
Return on investment					
Ease of renovation					
Quality service available					
Quick installation					
Turnkey solutions available					
Lifetime and risk considerations					
Timing vis-a-vis previous renovations					
Ease of maintenance					
Widely used solution					
Other benefits					
Improved comfort				*	
Improved value of property					
Social approval/status					
Environmental/societal motives/pressures					
Environmental considerations					
Expected future regulation					
Recommendation by experts				**	

Source: interviews and literature as presented above.

* Health and indoor air quality issues can, however, be major decision criteria

** Important for small municipalities

8 France

8.1 General overview

Buildings are responsible for 44% of total energy use in France, and constitute a major challenge for energy efficiency policies (NEEAP2 2011). While there has been a decline of specific energy consumption for space heating of about 20% since 1997, the energy efficiency of space heat use per m² is still lower than in several other European countries (Lapillonne 2011; Lapillonne et al. 2012).

France has a long history of energy efficiency policy, which has been significantly reinforced in recent years. The Grenelle de l'Environnement, a collective consultation between the state, the regional authorities and civil society representatives, defined a roadmap for ecology and sustainable development. This resulted in several mid-term and long term objectives; among others, the goal of reducing total energy use by 75% by 2050 and the goal of reducing energy use in existing buildings by 38% between 2008 and 2020 (Giraudet et al. 2011; NEEAP2 2011).

There are also efficiency standards for existing buildings (NEEAP2 2011). For major renovation of buildings larger than 1000 m² and built after 1948, the global Thermal Regulation sets a global energy performance target. For smaller buildings or minor renovations, the element-by-element Thermal Regulation sets a minimum performance level for elements replaced or installed, especially concerning insulation, heating, hot-water production, cooling and ventilation equipment. Labelling of energy efficient renovations has also been introduced: a 'high energy performance renovation, HPE 2009' label for buildings achieving primary energy consumption below 150 kWh_{ep}/m²/year and a 'low energy consumption building renovation, BBC 2009' label for buildings achieving primary energy consumption below 80 kWh_{ep}/m²/year (NEEAP2 2011).

Several measures to promote energy renovations and energy efficiency improvements have been available for years; however with several changes over the years. The current measures include (Commissioner-General for Sustainable Development 2009, Laurent et al. 2011; Economidou et al. 2011; EuroAce 2010; Baudry and Osso 2011):

- Several subsidies from national agencies such as the national energy efficiency agency, ADEME, and the housing agency, ANAH
- A tax credit of up to 16 000 € over 5 years for various energy efficiency measures
- Since 2009, a zero-interest loan for combinations of energy efficiency measures (that can be combined with the above-mentioned tax credit, provided that total annual household income is lower than 30000€)
- An energy saving obligation scheme for energy suppliers, in which several standardized actions in customers' premises pertaining to improved heating systems, ventilation and thermal renovation are eligible for energy saving certificates
- For social housing organizations: a low-interest loan linked to energy renovations
- Several programmes by local and regional governments
- Training of construction professionals: a training programme in energy saving for construction firms to recognise overall building energy performance and energy efficient techniques

However, until recently, while the retrofit market has grown, it has grown no faster than GDP and the costs of renovations are rising (Laurent et al. 2011). The number of energy efficiency improvements has grown since 2002, but still only represent 15% of all renovations conducted (Economidou et al. 2011). Achievement of the ambitious government targets is thus expected to require further efforts.

Table 8.1 presents an overview of the French building owners and decision makers by building type. The major owner types, their decision structures and barriers and drivers are then presented in the next section. Major refers here to building owner categories that share distinct characteristics and control a large share of the floor area. This has also involved some regrouping of owner types, which is explained in detail below.

Table 8.1. Major owners and decision makers for residential, public and office buildings

Building and owner type	Share of total building area, %	Decision makers and types of owners
Single-family detached		
Owner-occupied	41,4	Owners individually: private households
Rented	6,0	Owners individually (mainly private households)
Apartment buildings		
Owner-occupied	6,0	Owners collectively
Private rental	8,6	Owners (mainly private households), companies
Social rental	8,3	Owners: Social housing organizations
Public buildings		
State and local government	10	Owners: public bodies ¹⁷
Commercial office buildings		
Owner-occupied	4,8	Companies using buildings (e.g. corporate headquarters)
Rental		Professional property management companies, portfolio investors
Other	14,9	
Total	100	

Source: Eurostat; INSEE

8.2 Barriers and drivers of energy renovations among major building owner groups

8.2.1 Owner-occupied single-family houses

Owner-occupied single-family houses are the largest building type in terms of total building area in France, amounting to more than 41% of the total floor space in m². Here, the owner is the sole decision maker, and there are no legal obligations to conduct energy renovations. However, when renovations are made, there are requirements for the energy performance of building components that are replaced in buildings with a surface area of less than 1000 m² (MURE database 2011; NEEAP2 2011).

As mentioned above, there are several incentives for building owners to improve the energy efficiency of their buildings, especially the zero-interest loan which can be obtained for renovations including at least two energy saving measures. Local governments also have several additional programmes running to promote energy efficiency in their area. Additionally, the energy saving obligation scheme rewards energy utilities for energy saving measures. This includes several options that are suitable for homes such as double-glazing installation, attic insulation, new heating systems, etc. There is also a relatively extensive network of advice available. Information is provided by the State, local governments, utilities, energy agencies, associations and locally by energy information centers.

The main barriers to energy renovations in owner-occupied single-family homes can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are not the most critical barriers. However, home owners' decisions about energy efficiency investments are to some extent hampered by conflicting information or mistrust of information (Economidou et al. 2011). Other genuine

¹⁷ Of these, about one-third (120 million m²) are owned by the state and its operators and two-thirds (250 million m²) are owned by local or territorial governments (Plan Grenelle Bâtiment 2012)

uncertainties are not deemed barriers as home owners rarely evaluate their investments at this level of detail.

- **Financial barriers** include several critical ones. The feeling that renovations are too expensive was the most frequently reported barrier to energy renovations in a survey study by TNS-SOFRES/ADEME (2012). Initial costs are critical for detached home owners, as are long payback times and access to finance (Beillan et al. 2011). A lesser barrier that contributes to the difficulties is the uncertainty in regaining investments through improved resale value, as energy efficiency is not an important decision factor for most people when buying a house.
- **Organizational problems** are naturally not a major issue for owner-occupied single-family homes. However, short time-frames in decision making can play a certain role in terms of sub-optimal decisions with respect to the lifetime of the building, especially in the case of elderly home owners.
- **Lack of information and skills** is not considered to include critical barriers in French single-family homes. However, lack of attention and interest and lack of customer knowledge are lesser barriers (Economidou et al. 2011).
- **Transaction costs:** Our interviewees suggested that finding good professionals to conduct renovations is difficult. The cost of renovations has been rising, and customers want value for their money. A related barrier is high information search costs. Search costs are higher for households than for organizations. For example, Economidou et al. (2011) mention the difficulty of finding out about support schemes and appropriate steps due to a lack of a central source of such information. They also mention the poor quality and knowledge of contractors, limited know-how in the field of energy efficiency resulting in unsatisfactory retrofits as a barrier. Our interviewees also mentioned the difficulties of finding out about support schemes and their details, especially as the schemes are frequently changed. This is confirmed by a survey study by TNS-SOFRES/ADEME (2012).

However, single-family home-owners naturally do renovate their homes. Energy renovations in single-family homes are usually connected to renovations with other goals: often, the adaptation of the house to the family's needs (Beillan et al. 2011). These can also be immediate needs, such as a broken heating system or noise from windows. According to our interviewees, also aesthetic aspects can play an important role. The aim is to get a good quality home and save on energy costs, whereas energy aspects are more side-benefits that follow from the decision to make a renovation.

With this starting point, single-family home owners rarely have a systematic view of the building when making renovations, or include several upgrades in the same renovation. However, our interviewees and Beillan et al. (2011) also mention the role of national or local incentive schemes and government support programmes as triggers for more comprehensive energy renovations. The situation is improving, as there has been a long-standing programme for training building professionals in France. According to TNS/ADEME (2012), financial support instruments are the biggest incentive for energy renovations, followed by expert advice.

Alphéïs et al. (2012) note that single-family homes are the group with the greatest uptake of these support instruments. TNS-SOFRES/ADEME (2012) report that in 2011, 17.5% of all homeowners planned to conduct energy renovations and this figure has been fairly stable for several years, albeit recently somewhat reduced by the economic crisis. The most common types of renovations in 2011 were improvements to the building envelope (2/3 of the works), especially window and door replacements, followed by heating system upgrades (TNS-SOFRES/ADEME 2012).

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria:** Initial costs are dominant for single-family homes, and this is evidenced by the importance of support and loan schemes. Expected energy costs savings are also a very important criterion. Payback time and return on investment play a lesser role, as they are subject to greater uncertainties (Economidou et al. 2011), and homeowners rarely make sophisticated financial analyses.

- **Ease of renovation:** Beillan et al. (2011) stress the importance of integrative services in promoting energy renovations: hence, the availability of good quality services, quick installation and turnkey solutions are rated as quite important. According to a survey by TNS/ADEME (2012), 66% of renovations were conducted by professional companies (though this share has somewhat reduced recently). Our interviewees also stressed this point: because renovations are expensive, people expect to find good professionals and this has not been easy until now.
- **Lifetime and risk considerations:** Timing is important, as the need for a renovation is always the trigger for energy improvements. However, Beillan et al.(2011) stress that timing is not only considered in relation to the condition of the building components, but also to residents' changing needs. Ease of maintenance can play a role especially for active building components, and the availability of widely used solutions can be relatively important in creating confidence (see Economidou et al. 2011).
- **Other benefits:** Improved comfort is a major driver for single-family home owners (Beillan et al. 2011). However, Beillan et al. (2011) found that improving the value of property was more seldom a major factor in decisions concerning single-family homes, i.e., of medium importance. According to our interviewees, social approval or status can be important for some kinds of visible renovations, such as window replacements. Our interviewees also stressed the importance of aesthetic criteria.
- **Environmental and societal motives and pressures** are rarely the main decision criteria, but are today considered to have a certain role in decision making (see Beillan et al. 2011). Especially recommendations by experts are likely to make a difference in many cases. According to TNS-SOFRES/ADEME (2012), 50% of those conducting renovations sought expert advice.

8.2.2 Rented single-family houses

Rented single-family houses make up 6% of the total building area. Most of the buildings are owned by individuals (Bosvieux and Worms 2011). These owners tend to be fairly old and typically own only one dwelling, which was not typically acquired as an investment, but inherited or rented because of the need to move or in order to have a stable income from the rent (Bosvieux and Worms 2011).

The main barriers to energy renovations in owner-occupied single-family homes can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are likely to be perceived similarly as in owner-occupied single-family homes, as the owners are in effect quite similar to owner-occupiers, i.e., individual persons (see Bosvieux and Worms 2011). They are not the most critical issues, although conflicting information and mistrust of information can present a problem.
- **Financial barriers** are also likely to be similar as for owner-occupied single-family homes, for the same reason mentioned above. Hence, high initial costs, long payback times and access to capital and/or the cost of capital are deemed critical barriers.
- **Organizational barriers** include one critical barrier, the landlord-tenant dilemma. This naturally occurs when the owner has to make an investment of which the main beneficiary is the tenant (Economidou et al. 2011).
- **Lack of information and skills** are rated similarly to owner-occupied single-family homes, for the same reason mentioned above. There are minor barriers related to lack of attention and lack of skills, but our interviewees reported that awareness has risen significantly in recent years.
- **Transaction costs** are also rated similarly to owner-occupied single-family homes, for the same reason mentioned above. Almost all owners are non-professionals, and hence face high information search costs (Bosvieux and Worms 2011).
- **An additional barrier is the lack of tenant interest:** Tenants pay little attention to the energy performance of buildings; which does not encourage owners to improve energy efficiency.

Since the owners of single-family homes are private persons with usually only one property (Bosvieux and Worms 2011), the drivers for energy renovations are also largely similar as for single-family home owner-occupiers (see above), except for the benefits of lower energy costs, which in this case accrue to tenants. However, as the owners do not occupy their property and are not present on the site, their decision criteria are likely to be somewhat different.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are rated similarly as for owner-occupiers, as the level of professionalism and financial situation are not significantly different.
- **Ease of renovation** criteria are likely to have a greater weight than for owner-occupiers, as owners of rented property are less involved in the actual work. Especially quick installation can be important to avoid problems with tenants.
- **Lifetime and risk considerations** have similar weights as for owner-occupiers.
- **Other benefits:** Improved comfort and social status are naturally slightly less important for landlords than for owner-occupiers, and improved value of property is more important. Bosvieux and Worms (2011) report that one of the main reasons for renting a property is the desire to keep the family home in one's possession, hence value maintenance and enhancement are likely important.
- **Environmental and societal motives and pressures:** Rented properties reflect less on the person of the owner than do owner-occupied properties, hence environmental concerns are not likely to play an important role for landlord-owners of small properties. However, expected future regulations are rated somewhat higher (see Beillan et al. 2011), whereas recommendations by experts are likely to be of medium importance.

8.2.3 Owner-occupied multi-family houses

Owner-occupied multi-family buildings make up 6% of the total area of the building stock. In such buildings, decisions about renovations of the building are made by the owners collectively (the condominium association). According to ARC¹⁸ (2006), the condominium association is a legal entity represented by a "management agent", which can be one of the owners or a professional mandated representative. The management agent is supported and controlled by a board of trustees. Decisions about renovations are taken by an absolute majority (i.e, more than half of all shareowners need to agree and be represented in the meeting). However, there is no requirement for a renovation fund, although these are strongly advocated by ARC (2012).

The parties influencing the renovation decisions of apartment building owner-occupiers are similar to those influencing single-family home owners. Owners cannot be legally required to renovate, but when major renovations are conducted in buildings larger than 1000 m², they should improve global energy performance and there are component-specific energy requirements for minor renovations (NEEAP2 2011). Moreover, as described above, there are several incentive and support schemes.

The main barriers to energy renovations in owner-occupied single-family homes can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness:** Conflicting information and mistrust of information are likely to be a critical barrier (see Economidou et al. 2011). In particular, our interviewees stressed the residents' distrust toward companies and building professionals, which are seen to be charging excessive fees, as one of the most important barriers (see also ARC 2012).

¹⁸ Association de l'assemblée des co propriétaires (federation of condominium associations), which represents about 1 million out of 8 million dwellings, according to one of our interviewees.

Heterogeneous outcomes were also deemed a major problem by our expert interviewees: building professionals cannot guarantee that a certain level of savings is achieved.

- **Financial barriers:** High initial costs, long payback times and access to or the cost of capital are all rated as critical. This is in line with Beillan et al. (2011) who mention that including insulation in the renovation of an apartment house can add up to 40% to the costs, which is considerable for some owners. Our interviewees stressed the problem that the tax credits for energy renovations are not available for condominium associations as a whole – each owner has to take out their own loan to make use of them (see also Economidou et al. 2011). Moreover, Lopez and Berthier (2012) point out that loans (including soft loans) are not tailored for the kinds of long-term payback investments of more than 15 years represented by deep energy renovations. They also suggest that lending institutions do not have the necessary expertise to assess the effectiveness of works financed through loans. Low or uncertain resale value of the property is rated as a lesser barrier, which may play a role in apartments, which are more frequently sold.
- **Organizational problems:** There was a strong agreement among our interviewees that collective decision problems are the single most critical barrier. Decisions concerning renovations require an absolute majority, and this is only since a few years (earlier, a larger majority was required). Since owners are in diverse financial situations (and some co-owners may also not occupy their apartments), interests are heterogeneous (Laurent et al. 2011; ARC 2012) and this makes collective decisions difficult.
- **Lack of information and skills:** The above-mentioned collective decision problems reinforce the role of owners' lack of attention and interest and lack of knowledge and skills. These are problems in themselves (Economidou et al. 2011), but the need to inform and engage a sufficient majority of co-owners makes the situation even more difficult.
- **Transaction costs:** Similarly to the previous owner groups, high information search costs are a critical barrier to apartment owner-occupiers. The risk of failures in renovations is considered a lesser barrier, but nonetheless one that influences decisions (see Economidou et al. 2011), especially when decisions are made in a collective context.

Our interviewees stressed that the main driver for renovations is a more general need to improve the building: sometimes very urgently, for example in the case of a leaking roof or a heating system failure. Energy renovations are a side-effect of such renovations driven by other needs. According to Beillan et al. (2011), the main drivers for energy renovations among apartment owner-occupiers are to improve comfort, to cut energy bills and to increase the value of the apartment – or to avoid its depreciation and increased costs due to rising energy costs and maintenance charges, as one of our interviewees pointed out.

Our interviewees stressed the importance of an owner or group of owners who serve as initiators and leaders of the renovation. ARC (2012) also stresses the importance of sound management, including a general overview of the strengths and weaknesses of the building, as well as even a modest renovation fund to cover part of the renovation cost and the sales of energy savings certificates at a good price.

Beillan et al. (2011) also note that grants and funding programmes have been particularly important in mobilizing energy renovations in a co-ownership context; not only because of the financial benefits but also because of the technical support and expert advice provided especially by local and regional programmes. Moreover, they report that concerns over tightening standards and regulations are also important arguments in collective debates over energy renovations.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are naturally important, as many condominium associations are in a fragile economic situation (ARC 2012). However, because loans can be paid back in monthly charges, initial costs and payback times have equal weights, whereas lay people less frequently consider more sophisticated criteria like return on investment.

- **Ease of renovation:** Apartment owners are less engaged with the building and are more concerned about disruptions than single-family home owners. Hence, quality service and quick installation are top priorities. ARC (2012), in particular, stresses the co-operation between service providers and the condominium association as an important aspect of service quality.
- **Lifetime and risk considerations:** Timing is very critical in apartment buildings, where renovations are a rare occurrence and based on a close consideration of whether the renovation is really necessary considering the condition of the building. Ease of maintenance and the availability of widely used solutions are deemed somewhat less important.
- **Other benefits:** Our interviewees stressed that improved comfort and maintaining value of the property are important motives for apartment owner-occupiers to conduct energy renovations (see also Beillan et al. 2011), whereas social approval or status is estimated to have a somewhat lesser weight.
- **Environmental and social motives and pressures:** Environmental considerations are a side-benefit rather than a major criterion for energy renovations in apartments (Beillan et al. 2011). However, their analysis of completed energy renovations suggests that “regional or municipal support and incentive programmes played a major role, due to the technical support that they provided. Moreover, the noticed that the possible introduction of stricter energy efficiency requirements put forward by the officials administering the schemes convinced co-owners of the importance of the topic. Recommendations by experts are deemed a very important decision criterion also by our interviewees.

8.2.4 Private rented apartments

Private rental apartments make up 8,6% of the total floorspace. These are usually owned by private persons; institutional investors own only 3% of the private rental housing stock (Bosvieux and Worms 2011). According to Bosvieux and Worms (2011), private landlords tend to have very small portfolios: almost two-thirds of landlords own one dwelling and 90% own less than four units. The average is close to two dwellings, except in the Ile-de-France where it is 3.8 units. Often private landlords are retired executives or independent professionals who have quite a high income. They have a strong preference to manage their properties themselves. Less than 40% of rented homes are looked after by a property manager.

Slightly more than one-third of private rented apartments are homes in apartment buildings owned by a single landlord, whereas almost two-thirds are in condominiums (Bosvieux and Worms 2011). In the case of these two-thirds of the private rental apartments, the landlord-owners make decisions in the condominium assembly together with owner-occupiers, i.e., their situation is similar to that described in section 8.2.3). Hence, this section pertains to the more professionally managed end of the private rented apartments, whereas the individual landlords with just one or two properties are better represented by the barriers and decisions profiles described in section 8.2.3.

Following from the situation and the viewpoints expressed by our interviewees, the main barriers to energy renovations in private rented apartment buildings are likely to be as follows:

- **Genuine uncertainties regarding cost-effectiveness** are not likely to be particularly relevant, as the owners are not likely to analyse their investments at this level of detail.
- **Financial barriers:** High initial costs are deemed a lesser barrier (as owners are fairly wealthy, see Bosvieux and Worms 2011), but long payback times and access to capital or the high cost of capital are deemed critical barriers. Rental expenses are divided between landlords and tenants and have grown rapidly during the past years, which does not encourage landlords to invest in renovations, considering that rents are controlled over the duration of an individual tenancy (Bosvieux and Worms 2011).

- **Organizational problems:** The landlord-tenant (or landlord-tenant) dilemma is deemed a critical barrier, as landlords carry the cost of renovations whereas tenants reap the benefits from lower energy costs. There is legislation allowing landlords to recover half of the costs of renovations from tenants, but this requires fairly careful planning and documentation of the costs and benefits (Plan Batiment Grenelle 2011).
- **Lack of information and skills:** These are not considered to include any critical barriers, at least for the more professional category of private rental building owners.
- **Transaction costs:** Risks of failures in renovation are a critical barrier, since the renovation must provide benefits for the tenants in terms of energy cost reductions in order for the costs to be recoverable via rents (Plan Batiment Grenelle 2011).

Drivers for energy renovations are likely to be similar as for the owners of rented single-family homes (see section 8.2.2). However, some of the owners are more professional and well-organized, and hence also more subject to institutional pressures, e.g. expectations concerning future regulation.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are deemed to have the same importance as for owner-occupiers, as the level of professionalism and financial situation are not significantly different.
- **Ease of renovation** criteria are rated similarly as for owner-occupiers. Especially quick installation can be important to avoid problems with tenants.
- **Lifetime and risk considerations** are deemed to have a similar role as for owner-occupiers.
- **Other benefits:** Improved comfort and social status are rated similarly as for owner-occupiers.
- **Environmental and societal motives and pressures:** Environmental concerns are similarly as for owner-occupiers. However, expected future regulations are rated somewhat higher (see Beillan et al. 2011), whereas recommendations by experts might be slightly less important.

8.2.5 Social rental housing

Social rental housing accounts for about 8,3% of the total floor area. Social housing provision in France is provided by 'HLM' organisations, which are specific actors entrusted by the state to fulfill a mission of general interest, as well as to a lesser extent by semi-public enterprises and some non-profit associations (CECODHAS 2012). Rents are based on the net construction cost, which is lowered by subsidies (from the state and local authorities) and tax incentives. Access to social housing is limited by income ceilings, which are, however, relatively generous and thus include a large share of the population. Nevertheless, over the past three decades the sectors has seen a constant increase in the proportion of poor households, with currently 35% of all tenants on incomes below the poverty line (CECODHAS 2012).

The decision making of social housing providers is highly regulated by the supervisory body, MILOS. The umbrella organization of social housing federations has a large role (Bougrain 2012). For example, following the Grenelle de l'Environnement, the social housing associations agreed with the state to a plan to renovate 800,000 housing units by 2020. Other parties influencing social housing organizations include the local authorities and local energy agencies. Social housing organizations are encouraged to undertake renovations through property tax rebates and the possibility to charge higher rents. Landlords who undertake energy efficiency renovations can also receive and trade white certificated under the Energy Saving Obligation Scheme (Bougrain 2012).

The main barriers to energy renovations in social housing organizations are summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are not considered to include any significant barriers. This is due to the fact that strategic asset management is well developed (Bougrain 2012) and in recent years, energy audits have increased knowledge of energy consumption per dwelling and of the expected energy savings (Nieboer et al. 2011). However, Economidou et al. (2011)

indicate that uncertainty about building diagnostic tools and appropriate investment standards and protocols to plan routine and on-going energy retrofits are a barrier for social housing in France.

- **Financial barriers**, however, include several critical ones. High initial costs are a significant barriers. High initial costs are a concern, as the costs for major refurbishments can be very high (Nieboer et al. 2011). Moreover, payback times for major refurbishments can be long and there are limitation to the extent to which rents can be raised to cover the costs of energy efficiency investments (Milin and Bullier 2011; Bougrain 2012). Access to capital and the cost of capital are further major barriers, as social housing organizations cannot exceed their debt rates (Milin and Bullier 2011). Other categories of financial barriers are not rated as significant overall: However, low or uncertain resale values might be critical for certain social housing owners. For example, Nieboer et al. (2011) and Bougrain (2012) mention that investments do not necessarily increase property values in areas of low demand.
- **Organizational problems**: Our interviewees and several authors mentioned the landlord-tenant dilemma as a major barrier: it is the residents that benefit from the lower energy costs whereas the owner has to make the investment (Nieboer et al. 2011; Giraudet et al. 2011).
- **Lack of information and skills**, in general, is not a major type of barrier for social landlords, as they are large and professionally managed organizations.
- **Transaction costs** are also in general not particularly severe for professionally managed social housing organizations. However, risks of failure in renovations do constitute a severe barrier as the investor must ensure that energy efficiency investments will lead to effective decrease of tenants' energy expenditures (Plan Batiment Grenelle 2011).

There are several drivers for energy investments in social housing organizations (Bullier et al. 2011). Buildings with lower energy costs can expect lower vacancy risks and payment defaults than others. Property values are better maintained and investment lifespans are extended by anticipating energy efficiency requirements and rising energy costs and taxes.

Moreover, as one consequence of the Grenelle de l'Environnement, the social union for housing entered into an agreement with the government entailing a plan to renovate the 800,000 most energy consuming social housing units from 2009 to 2020, and to renovate 100,00 units in 2009-2010. This is to be funded by a low-interest loan offered by the Caisse des Dépôts (EuroAce 2010).

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria**: Financial criteria are important or moderately important. Initial costs can be important due to debt limits and on the other hand, expected energy savings are important because the social housing owners have made major commitments to reduce energy consumption.
- **Ease of renovation**: Ease of renovation can be important in order to smooth the process with tenants (Bougrain 2012), and quick installation is deemed very important for the same reason. The availability of turnkey solutions is not deemed to be equally important for owners of large housing stocks.
- **Lifetime and risk considerations**: Timing is relevant as professional rental housing managers have maintenance and renovation policies and schedules (Bougrain 2012). Ease of maintenance and the availability of widely used solutions are estimated to have a medium weight. Indeed, Bougrain (2012) reports that social landlords are still developing experience in comprehensive renovations.
- **Other benefits**: Improved comfort is highly relevant for getting tenants on board, as renovations need to be discussed with tenants and provide them with benefits (Bougrain 2012). Improved value of the property and social status have a medium role, as energy renovations might not significantly contribute to these goals in all cases (Bougrain 2012).
- **Environmental and societal motives and pressures**: Environmental considerations are high on the regulators' and owners' agendas, and some social housing organizations have environmental policies and management systems (Nieboer et al. 2011; Bougrain 2012). The high level of regulation

and coordination also give expected future regulations a high priority. However, external experts are less important because of existing in-house competencies.

8.2.6 Public buildings

Public buildings make up about 10% of the total area of the building stock. According to the French Exemplary State Strategy, the state and other levels of government are expected to apply the principles of environmental and social responsibility (NEEAP2 2011). This applies to the behavior of officials and to public procurement and is specified in targets set in annual circulars. On the basis of these, among other measures, energy audits have been conducted in a large share of the state buildings (NEEAP2 Plan 2011).

According to the Department of the Commissioner-General for Sustainable Development (2009), the "Grenelle 2" Bill requires works to improve energy efficiency in buildings used by the tertiary sector to be completed within 8 years as of 1 January 2012. The existing local authority buildings mainly affected by the measures - i.e. local authority administrative buildings, schools, cultural and social buildings and various other regularly heated premises - have an estimated surface area of 130 million m². About half of these are estimated to be owned by municipalities and half by regional state authorities.

According to one of our interviewees, however, the state does not always set such a good example, for example in terms of systematically displaying energy performance certificates. Local public buildings, however, are encouraged to renovate by the availability of grants and political pressure from the electorate. Hence, local governments usually try to make at least a few exemplary public buildings. However, one of the main barriers to renovations relates to public budgeting, with separate budget lines for investments and running costs. The renovation of buildings is further complicated by the large number of parties involved (central administration, building users, designers, etc.)

The main barriers to energy renovations in public buildings can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** include one critical barrier: uncertainty concerning measurement and verification of savings (Economidou et al. 2011). This is particularly in the case of energy performance contracting, which is one route for public authorities to finance long-term energy investments (Mayer and Ghiran 2011).
- **Financial barriers:** Initial costs are a critical problem for public-sector organizations because annual investment budgets are limited (Mayer and Ghiran 2011). Access to and cost of capital are mainly a barrier for municipalities.
- **Organizational problems:** Collective decision problems are deemed a critical barrier, in this case referring to complex decision making processes and lack of leadership (Mayer and Ghiran 2011). Another critical barrier in this category consists of public budgeting procedures, in particular, the separation between maintenance and investment budgets, which limit the scale of possible investments, especially in years of budget contraction (Mayer and Ghiran 2011, also stressed by our interviewees).
- **Lack of information and skills:** Lack of customer attention and interest is rated as a barrier, albeit a lesser one. Energy costs are only one of the many issues that public sector organizations need to deal with. Energy costs are only a small share of the total cost structure, and hence gain limited management attention. Staffing for energy management is insufficient, leading to a lack of competent specialists (Mayer and Ghiran 2011), which is here rated as a critical barrier.
- **Transaction costs** are not deemed important barriers, in comparison to the other owner types, as owners of public buildings have market power.

The major driver for energy renovations is that France has made a major commitment to exemplary action by the state and regional authorities (NEEAP2 2011; Broc 2012). This includes the requirement to conduct energy audits and implement cost-effective audit recommendations, make regional climate and energy plans, and develop training for local authorities as well as label and award exemplary regions, as well as

monitoring of energy use and mandatory greenhouse gas emission reporting by public sector bodies. There are targets to reduce the energy consumption of public buildings by 40% by 2020.

Moreover, energy bills have increased by 22% between 2005 and 2010, which has raised awareness of energy costs (Broc 2012). These should be major drivers for energy renovations. Moreover, there is work underway to further facilitate energy performance contracting, which would help in financing energy renovations.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria:** Our interviewees pointed out that government bodies have a “social planner” approach and hence a lower discount rate: financial benefits for the building owner are hence less relevant. Initial costs are, however, deemed important, in spite of the greater professionalism of public building owners, because of annual budget limitations and overall limited budgets.
- **Ease of renovation** is less relevant for public sector organizations than for other owner types. However, quick installation is quite relevant considering the need to relocate e.g. schools, hospitals, and other major public services.
- **Lifetime and risk considerations** have a similar weight as in other owner groups. Timing, maintenance and widely used solutions play a significant role considering limited budgets and staff capacities (Mayer and Ghiran 2011).
- **Other benefits:** Improved comfort and value of property are estimated to have a medium weight. However, social approval in terms of legitimacy and political support were deemed by our interviewees as one of the most important decision criteria for the public sector. Renovations of public buildings can be a visible way to display accomplishments of the local government to the electorate.
- **Environmental and societal motive and pressures:** The environment and climate change mitigation are important concerns for the public sector in France, due to the Grenelle agreement and the commitments made. However, external experts are deemed to play a lesser role in this case.

8.2.7 Owner-occupied office buildings

Commercial office buildings make up about 4,8% of the total building area. Traditionally, owner-occupancy has been more common in France than in, e.g., the UK (Guy and Shove 2000). However, in a recent survey of corporate property managers of large companies (Nappi-Choulet and Decamps 2011), only 10% of all respondents owned 100% of the office space they occupied, with the average being 38% of buildings held as property.

Parties influencing decisions include the state, local governments, utilities, energy agencies and associations. According to Nappi-Choulet and Décamps (2011), the main drivers for energy efficiency and sustainability issues in office buildings derive from public policy (especially the Grenelle de l'Environnement) and the new heat demand regulations requiring low heat consumption (RT2012), as well as plans to further regulate heat consumption in existing buildings. Large listed companies are also required to issue corporate social responsibility reports, and the reduction of building energy use is one way to demonstrate progress in corporate social responsibility. As a specific measure, Nappi-Choulet and Décamps (2011) mention the HPE (High Energy Performance) and HQE (High Environmental Quality) labels, which have gained popularity especially among large listed companies. Utilities can also gain energy saving certificates for measures implemented in offices, and in 2010 about 7,5% of these actions were made in offices. Finally, employees and the general public can have an influence via, e.g., expectations toward corporate social responsibility.

While there is a lot of discussion on “Green value” from better office buildings, there are also factors hindering energy renovations. The main barriers to energy renovations in owner-occupied office buildings are summarized below:

- **Genuine uncertainties regarding cost-effectiveness:** Uncertainty concerning measurement and verification of energy saving is rated as a critical barrier, as businesses need to make detailed calculation of costs and benefits. Carassus (2010) has found that the performance of buildings with the high energy performance and low energy consumption certificates does not always meet expectations due to occupant and maintenance behavior.
- **Financial barriers:** High initial costs and long payback times are rated as critical barriers. This is because owner-occupiers want to retain their capital for productive investments in their core business.
- **Organizational barriers:** Collective decision problems are likely to be a critical barrier, especially for large corporations with several competing investment projects.
- **Lack of information and skills:** Lack of customer attention and interest and lack of knowledge and skills are critical barriers, according to our experts, especially for small and medium-sized enterprises that lack dedicated staff in charge of energy issues. Energy usually represents a small share of all costs for enterprises in the tertiary sector; hence there is a lack of incentive to make energy efficiency investments.
- **Transaction costs** are not deemed to include any critical barriers, as most office owner-occupiers have the resources to deal with these issues.

According to our interviewees, the main drivers for offices to consider energy renovations are firstly to gain a ‘showcase’, i.e., to gain marketing tool for the company and secondly to reduce costs. Anticipation of legislation is also a major driver according to Nappi-Choulet and Décamps (2011). Large listed companies are also required to issue corporate social responsibility reports, and the reduction of building energy use is one way to demonstrate progress in corporate social responsibility. Green value and environmental and energy certification are popular topics in the business community. However, the situation of smaller companies is not as encouraging, as they are mainly driven by cost considerations (Nappi-Choulet and Décamps 2011).

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** dominate, as financial performance is the main motive for businesses, which was also stressed by our interviewees. Initial costs are important because of the scarcity of capital, but payback times and returns on investment are also considered in professional business decisions.
- **Ease of renovation:** The availability of quality service is likely to have a medium weight in office buildings, whereas quick installation and turnkey solutions have more weight since time is money in business.
- **Lifetime and risk considerations:** Timing vis-à-vis previous renovations is critical, as decisions are made on the basis of renovation plans and budgets. Ease of maintenance and widely used solutions are also valued, as the office property is not usually the core activity of the company, and staffs for energy management and sustainability issues are usually small (Nappi-Choulet and Décamps 2011).
- **Other benefits:** Improved comfort and improved value of the property are also important decision criteria. These relate to such issues as employee well-being and the influence of sustainable buildings on the attractiveness of office locations, and feature highly in the decisions of companies with an interest in green buildings (Nappi-Choulet and Décamps 2011). A lesser, related factor is social status and approval.
- **Environmental and societal motives and pressures:** Environmental considerations are not rated as very important in decisions to make energy renovations by the average office owner-occupant. However, expected future regulations can have a medium importance (see discussion above).

Recommendations by external experts are not likely to have a large influence, as the companies owning offices rely on their in-house expertise.

8.2.8 Rented office buildings

Rented office buildings are owned by professional office property owners or by portfolio investors. The owners' attention to the specific qualities of the office buildings owned is likely to depend on their weight in the investment portfolio, i.e., whether real estate forms a large part of the total assets owned.

For professional office space owners, discussions about "green value" are one of the most topical interests in major energy retrofits. Green value refers to e.g. improved staff productivity and longer staff retention in more sustainable office buildings (Brunel and Crassus 2010). In the long term, such buildings are expected to command higher rents and have shorter vacancy times due to their greater attractiveness. Future pressures might also derive from the relatively stringent requirements on new office buildings, as the "Grenelle de l' Environnement 2012" Building Energy Regulation has placed the requirement of maximum 50 kWh/m² for new buildings in the tertiary sector since 2011 (RTD EDF Transport 2011). This offers prospective tenants (at least in principle) the choice of new buildings with very low energy consumption, which might also influence expectations concerning existing buildings.

However, professional office property investors examine the profitability of their investments very carefully, which was also emphasized by our interviewees. Energy usually represents a small share of the total costs of enterprises in the tertiary sector, which leads to a lack of incentive to make energy efficiency investments. The main barriers to energy renovations in rental office buildings are summarized below:

- **Genuine uncertainty regarding cost-effectiveness:** There are no critical barriers in this category, as the building space owner is more concerned about the rental value of property than about energy consumption, which is paid for by tenants.
- **Financial barriers:** High initial costs and long payback times are rated as critical barriers. According to Brunel and Celerier (2010), since the costs of deep energy renovation are high, the payback time for the owner is often greater than 25 years. Furthermore, the expected and recorded savings in charges for office space users are minor and negligible compared with the overall rent for office space. According to Novethic Research (2012), the inadequate return on investment is the largest barrier to more investment in eco-efficient office solutions.
- **Organizational problems:** The landlord-tenant dilemma and collective decision problems are rated as critical barriers. Nappi-Choulet and Décamps (2011) indicate that tenants are much less interested in the sustainability aspects of office buildings than are owners, and are more concerned about rent increases due to energy renovations.
- **Lack of information and skills:** Lack of attention and interest and lack of knowledge and skills are rated as critical barriers. While better energy performance may allow for higher rents, issues like location and functionality are much more important for the returns of office property owners (Carassus 2011). A lesser, but related barrier is the lack of tenant interest: tenants pay little or no attention to the energy performance of buildings, which does not encourage owners to improve energy efficiency.

Novethic Research (2012) has surveyed the energy management practices of major property funds with large building portfolios. According to them, labeling and legislation concerning EPCs are major drivers. About 7% of the properties owned by property funds had some kind of certification and 33% have made energy performance contracts with property managers. One-third of all property funds reported that they systematically assess energy efficiency upgrades when premises are vacated by tenants.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria:** Various financial criteria related to the renovation all are equally important: initial cost, payback time and return on investment, according to our interviewees. However, calculations of return on investment may include significant uncertainties (Brunel and Celerier 2010), as it is still difficult to estimate what the rent differential of energy efficient buildings will be (which in turn favours shorter-term financial indicators).
- **Ease of renovation:** The factors are likely to be similarly important as for owner-occupied office space. Time has value and hence quick installation and full service packages have importance.
- **Lifetime and risk considerations:** As in the case of owner-occupied office space, timing is a top priority as renovations are made to avoid depreciation and obsolescence of the property (Novethic Research 2012). Ease of maintenance and the availability of widely used solutions can facilitate the decision and reduce future costs and risks.
- **Other benefits:** Improved value of property is an important potential benefit for professional office space owners, and one which has fairly immediate financial implications. Improved comfort can play a certain role, but more important according to our interviewees is the social status related to a certain office property, which may also have implications for rent levels and vacancy rates.
- **Environmental and societal motives and pressures:** Environmental considerations are not rated as very important in decisions to make energy renovations by professional office space owners. However, expected future regulations are rated as fairly important, as e.g. Novethic Research (2012) reports that the anticipation of future regulations was an important motive for 61% of the respondents, and about one-third of the respondents had already estimated the costs of fulfilling the Grenelle 2 requirements to reduce energy consumption for commercial property by 38% by 2020. Recommendations by external experts are not likely to be particularly important, as the companies owning offices rely on their in-house expertise.

8.3 Discussion on barriers and drivers of energy renovations

There has been a rapid growth in awareness of the importance of energy renovations in France during the past few years, largely due to determined campaigns by the state and agencies like ADEME. This is more visible among professional property owners than residential owner-occupiers, but awareness seems to be fairly widespread (TNS-SOFRES/ADEME 2012).

However, there are several barriers to translating the awareness into action (Table 8.2). Financial barriers are predominant. They influence different owner groups somewhat differently, but high initial costs, long payback times and access to capital are widespread problems. Another common barrier type is organizational. This is particularly severe for owner-occupied apartments, where reaching an agreement among condominium co-owners is difficult, which also intensifies the influence of other barriers. As concerns rental housing owners, measures have been taken to reduce the landlord-tenant dilemma through legislation enabling a sharing of costs among landlords and tenants, but this requires quite careful planning and the meeting of certain criteria by owners. In public and office buildings, competition among different types of investments and at different levels of the organization slows down the pace of energy renovations. There are also groups where attention to energy issues is still not so strong: these include condominium owners as well as public and office buildings, where energy costs are still only a minor part of total costs. High information search costs are a problem for private households, which still struggle to figure out how to best finance their renovation and to find good quality service providers.

Table 8.2. Most widespread and critical barriers to energy renovations for the different owner groups

	Owner-occupied single-family homes	Rented single-family homes	Owner-occupied apartment buildings	Private rented apartment buildings	Social rented apartment buildings	Public buildings	Owner-occupied office buildings	Rented office buildings
Genuine uncertainties regarding cost effectiveness								
Conflicting information, mistrust of	Yellow	Yellow	Red					
Heterogeneous outcomes			Red					
Uncertainty in measurement/verification of					Yellow	Red	Red	
Financial barriers								
High initial costs	Red	Red	Red	Yellow	Red	Red	Red	Red
Long payback time	Red	Red	Red	Red	Red		Red	Red
Access to/cost of capital	Red	Red	Red	Red	Red	Red		
Unwillingness to incur debt								
Occupant take-back								
Low/uncertain resale value of property	Yellow		Yellow					
Organizational problems								
Landlord-tenant dilemma		Red		Red	Red			Red
Collective decision problems			Red			Red	Red	Red
Short timeframe of decisions	Yellow							
Public budgeting practices						Red		
Lack of information and skills								
Lack of customer attention and interest	Yellow	Yellow	Red		Yellow	Yellow	Red	Red
Lack of customer knowledge	Yellow	Yellow	Red			Red	Red	Red
Lack of reliable advice								
Unsophisticated financial analysis								
Transaction costs								
Lack of skilled service providers	Red							
High information search costs	Red	Red	Red					
Switching costs, concerns over disruption								
Risks of failures in renovation			Yellow	Yellow	Red			

Source: interviews and literature as presented above.

In spite of these barriers, there are also several drivers for energy renovations. Whereas cost savings are an important driver, more societal and long-term concerns appear to have more influence in France in this area than in some other countries. Overall awareness has risen and there are several policy measures in place to promote renovations thanks to the Grenelle de l'Environnement agreement. Several parties are actively involved in promoting energy renovations:

- **Public bodies:** Compared to many other countries, the role of the state and the mobilization of the main national bodies seems to be a more visible influence. Ambitious targets set in the Grenelle agreement have served to create awareness and grants, tax incentives, training programmes, labels and advice networks are serving to facilitate renovations.
- **Companies offering solutions:** The construction industry in France consists of several small companies. There are hence not so many companies yet actively promoting a holistic view of the building or actively offering comprehensive energy refurbishments. However, there is a large nation-wide training programme working to improve this situation.
- **Associations:** One of the active players in the field has been the Plan Bâtiment Grenelle, a collaboration of a large chain of actors in construction and real estate aiming to implement the

targets of the Grenelle de l'Environnement. Twenty working groups under this umbrella are working to implement and improve various measures such as the zero-interest loan or energy performance guarantees. The participating organizations also offer support for their own constituencies, e.g., the association for condominium owners, ARC, offers support for condominiums and promotes long-term maintenance plans and a renovation funds.

- **Banks** are central in distributing the zero-interest loans and dealing with the related documentation (eligibility criteria, evidence of works conducted). However, according to our interviewees, they are not particularly interested in energy renovations today.
- **Energy companies** participate in energy renovations via the energy obligations scheme. Several of the measures that are eligible for certificates pertain to energy renovations. As concerns decision criteria, there are a few criteria that are highly important for all owner groups (Table 8.4.2). Initial costs are important for all building owner groups, albeit for somewhat different reasons. Quick installation and timing vis-à-vis previous renovations are also important criteria for all groups. The availability of quality services is important for residential building owners, with less market power.

Renovations are usually made when building components need to be replaced, and this is the main opportunity for integrating energy saving solutions. As one of our interviewees pointed out (see also Beillan et al. 2011), the change of ownership is another occasion for renovation and the integration of energy improvements. The availability of widely used solutions is also an important criterion for several groups, as is expected future regulation.

Some additional criteria were proposed by our interviewees. The expected amount of energy cost savings are important for many groups of owners: for owner-occupiers they are one of the keys motivation for engaging in an energy renovation. They are particularly important for rental housing providers, which need to be able to show that cost savings will be achieved in order to include the costs of the renovation in the rent, and they are particularly important for social housing providers, which have targets to reduce energy use. One of our interviewees also suggested that aesthetic aspects can be an important criterion for some homeowners.

Table 8.4.2: Most important decision criteria for the different owner groups

Criteria	Owner-occupied single-family homes	Rented single-family homes	Owner-occupied apartment buildings	Private rental apartments	Social rental housing	Public buildings	Owner-occupied office buildings	Rental office buildings
Financial								
Initial cost								
Payback time								
Return on investment								
Ease of renovation ¹⁹								
Quality service available								
Quick installation								
Turnkey solutions available								
Lifetime and risk considerations								
Timing vis-a-vis previous renovations								
Ease of maintenance								
Widely used solution								
Other benefits								
Improved comfort								
Improved value of property								
Social approval/status	*							
Environmental/societal motives/pressures								
Environmental considerations								
Expected future regulation								
Recommendation by experts								

Source: interviews and literature as presented above.

* can be important for some kinds of renovations, e.g. windows

¹⁹ One of our interviewees pointed out that this depends on whether buildings are renovated when occupied or in connection with a change of ownership, in which case, renovations can be made in a more relaxed schedule on empty buildings.

9 Germany

9.1 General overview

In Germany, there are 17.8 million buildings. 40 % of them were built between 1948 and 1978. There are 14 million single- or two-family houses. The new building rate is less than one per cent per year and the renovation rate of the existing building stock is one per cent. (Kraus 2011.) About 80 % of today's building stock will remain in place beyond 2050 and new buildings that will be built in the coming 40 years will constitute 20-30 % of the building stock in 2050 (Neuhoff 2011).

The largest potential for saving energy in Germany is in the housing stock. About three times as much energy is required for heating in the existing building stock as in new buildings. About 85 % of total energy demand is used for heating rooms and for hot water in private households. (dena 2012). The German government has committed to reducing the heat demand in the building sector by 20 % by 2020 and the primary energy demand by 80 % by 2050. The government aims that new buildings built after 2020 will be climate neutral. The reduction of energy demand will require efficiency improvements and therefore a thermal retrofit of the existing building stock is essential. (Neuhoff et al. 2011.) There are, however, results that show that the refurbishment activities of homeowners in Germany are far below what is needed to meet these ambitious goals (Stiess and Dunkelberg 2012, Bürger 2012).

The share of the net dwelling area of single- and two-family houses of the whole living space of dwellings was 59 % in Germany in 2011. There are differences in different parts of the country whether the dwellings are owner-occupied or rented. In the large German city states, in Berlin and in Hamburg, the ownership quota is quite low: in Berlin 15 % and in Hamburg 23 %, but on average it is ca. 46 %. The federal states that are more rural have higher ownership quotas: in Saarland, Rheinland-Pfalz, Niedersachsen, Baden-Württemberg and Bayern the ownership quota is over 50 %. (Statistisches Bundesamt 2010.)

In Germany, legal requirements to the thermal and energy performance of buildings have existed since 1952. Until 1977, the focus of those requirements was placed on the health and building safety (moisture, mould, etc.), which was expressed by minimum thermal resistance coefficients of the building shell. Later on, the required values were revised and tightened several times. (ENPER-EXIST 2006.)

The first Heat Insulation Ordinance (Wärmeschutzverordnung) came into force in 1977. It set up the first energy based requirements concerning component U-values or mean U-values. In 1984, the second Wärmeschutzverordnung established a maximum mean U-value for the building envelope and in 1995, the third revision of the ordinance changed the requirements from the component or building-envelope level only to a maximum net energy demand for heating and a maximum mean U-value for the building envelope. The first Energy Saving Ordinance (Energieeinsparverordnung, EnEV) in 2002 (slightly revised in 2004) made the next step towards a maximum primary energy demand for heating, ventilation and domestic hot water and again fixed a mean U-value for the building envelope. The second EnEV in 2007 resulted from the EU Energy Performance of Buildings Directive and therefore took into account the primary energy demands for heating, cooling, ventilation, lighting and (domestic) hot water by setting up a maximum value dependent on a reference building with defined standard technologies, along with a maximum U-value for the building envelope. (ENPER-EXIST 2006.)

Governmental buildings are set under stricter requirements than other buildings. For example, the buildings of the federal government in Berlin have to fulfil the requirement to perform 30 % to 40 % better than stipulated by the EnEV requirements. This applies for both new and existing buildings (decision of the Bundeskabinett/ Federal Cabinet as of 11/12/1991). In addition, there are several city administrations that demand a better energy performance quality for their own buildings and for buildings that are going to be built on their ground. In general, public buildings in Germany are not subject to higher requirements concerning retrofitting than other buildings. (ENPER-EXIST 2006). The next revision of the EnEV with strengthened requirements was introduced in 2009. The goal was to reduce the energy, heating and warm water demand by 30 % for old and new buildings. A new reduction of further 15 % has been introduced in 2012 (Bundesministerium für Justiz 2012) however being limited to new buildings. At present, the outer

walls of residential buildings are being thermally retrofitted at an annual rate of ca. 0.8 %, the roof at a rate of 1.1 % (IWU and BEI 2010). The government target for annual thermal retrofit rate is 2 %. (Neuhoff et al.2011.) The German Energy Agency (dena) suggests a three per cent annual rate (Stiess et al. 2009b).

In Germany, the main financial mechanism to get a loan for energy renovation is the financing through the Kreditanstalt für Wiederaufbau (KfW). It is a public bank that is jointly owned by the Federal State and the Bundesländer. In 1996, the KfW launched a set of preferential loans to finance energy efficiency projects through public tax exemptions for all money invested in efficiency projects and through direct public subvention. (T'Serclaes 2007.) In Germany, the financial incentives of the KfW are targeting the overall energy performance. There is also financial aid available to perform energy audits. (Huber et al. 2011.)

Table 9.1 presents an overview of the major owners and decision-making structures by building type. In the following chapters the most important types of owners, stakeholders and decision making structures will be described in more detail. "Important" refers here to categories that have a large share of the floor area and share distinct characteristics. The focus is on presenting the barriers the stakeholders face when deciding over energy investments and the drivers that encourage them to make energy investments.

Table 9.1 Major owners and decision makers for residential, public and office buildings

Building and owner type	Share of building area, %	Decision makers and types of owners
Single-family, detached		
owner-occupied	25,8	Owner occupant
rental	5,4	Landlord
association of owners (occupied)	0,9	General assembly of owners (occupier)
Single-family, attached		
owner-occupied	9,6	Owner occupant
rental	2,4	Landlord
association of owners (occupied)	0,3	General assembly of owners (occupier) (unanimous resolution required)
Multi-family		
Rental	23,0	Landlords, housing co-operatives
Association of owners (occupied)	7,1	General assembly of owners (occupier) (unanimous resolution required)
Public buildings		
miscellaneous	4,5	Local and state governments, public institutions
Office building		
owner-occupied	5,0	Owner occupant
rental		Real estate investors, large companies,
Other	16	
Total	100	

Source: own compilation

9.2 Barriers and drivers of energy renovations among major building owner groups

9.2.1. Owner-occupied single-family detached and attached houses

Owner-occupied single-family detached houses make out the largest building type in terms of total building area in Germany, amounting to circa 26 % of the floor space in m² of the building stock considered here. Owner-occupied single-family attached houses form 9.6 % of the floor space of the building stock considered here. Together they form a share of 35.4 %. Detached owner-occupied single-family homes belonging to an association of owners form a small share of 0.9 % and attached homes only 0.3 %. In the following, the owner-occupied single-family detached and attached dwellings are considered as one group because there are no large differences between the two. The owner-occupied single-family homes detached and attached belonging to an association of owners have been left out, because they are such small groups and there the decision making differs fundamentally from single-family owner-occupied homes.

According to Stuess et al. (2009b), radical changes in residential energy use occur as an outcome of a complex investment decision. This decision is shaped by the interplay of socio-technical, institutional, economic and cultural and social factors. The life-cycles of the building and its components open a “window of opportunities” with economic considerations, socio-cultural norms and expectations, cognitive frameworks, life style orientations as well as socio-demographic factors that must be taken into account. In owner-occupied single- or two-family homes, obviously, the owners make the energy investment decisions. However, federal and regional support schemes influence these decisions through financial means, as do utilities providing financial support for certain technologies or installers, who provide discounts for certain technologies or labels. (Stuess et al. 2010, Bürger et al. 2011.)

In an empirical study amongst 44 German households, Stuess et al. (2009a) found out that if we want to understand households’ investment behaviour properly, we must understand that households’ investment decisions related to the improvement of energy efficiency are always made in a state of uncertainty. For example, nobody can predict exactly the development of energy prices. Moreover, deciding which kind of energy saving investment should be chosen is a difficult task because there are many technical options with different outcomes. Homeowners do not behave rationally in the sense that they calculate life cycle costs of their options and tend to choose the option, which pays for itself first. People tend to be systematically biased towards short term investment paying only little attention to long term economic benefits. Energy efficiency refurbishments can be characterised as long term investments. In the sample of Stuess et al. (2009b) even ecologically interested people only had broad ideas about the size of their energy consumption. Consequently, many people did not calculate even roughly the amount of energy savings owing to their energy investment decisions. For most energetic modernizers, it was most important to use less energy in the future, unless they could not estimate the amount of energy saved. Most of them were convinced that the additional costs would pay in the long run. However, there were others who carried out energy efficient improvements, although they were convinced that these investments would not even pay off in monetary terms at all.

However, another survey among 2000 owners of single- and two-family houses concerning thermal retrofit found out that households have emphasised that retrofits concerning energy efficiency improvements need to be economically attractive. Financial concerns rank highest among homeowners’ concerns about retrofits. Financial support mechanisms are important in the retrofit planning stage as homeowners are making decisions about the retrofit and its thermal component. (Neuhoff et al. 2011.)

Yet another study among 1008 homeowners in Germany (Stuess & van der Land 2010) showed that the decision towards refurbishment usually results from an alliance of different motives. Decisions for energy-efficient refurbishment are shaped by a combination of wants and everyday needs, like comfort, convenience, status, belonging and economic aspects. According to the study, homeowners want to reduce energy consumption and energy costs, but the energy saving methods need to correspond

to other wants and needs of the everyday life. The decision is also influenced by homeowners' attitudes towards technology. Mistrust in technology can pose a barrier to the investment. Therefore, energy-efficient refurbishment should be communicated differently to various target groups. Information barriers can arise from a lack of knowledge. Many homeowners underestimate the energy-saving potential of their homes. Customised information and professional energy advice can support homeowners' energy advice.

Studies have shown that consumers are risk averse with respect to losses and risk seeking with respect to gains. In addition, individual welfare changes are greater from expected losses than from gains of the same magnitude. (Groba and Traber 2010.) Therefore, the energy refurbishment investments face a two folded problem: the expected gains are not that large and the magnitude is also uncertain, because it also depends on the occupant's future behaviour and the risk of something going wrong during the renovation process might seem higher than it actually is statistically seen.

The state-owned German KfW Promotional Bank grants low-interest credit loans for the retrofit of buildings for private households. The support provided by the grant or loan (with preferential interest rate and loan relief) covers a share of the total retrofit costs. A part of these loans is paid when the intended energy-performance improvement has been calculated according to the DIN V 18599 and proves to be better (by a specified percentage) than the common requirements. Since 2007 the KfW Promotional Bank offers a new system that gives subsidies for energy efficient retrofitting to private owners of single-family houses, twin-family houses or apartments. (ENPER-EXIST 2006; Neuhoff et al. 2011.) However, the low volumes of investments under the introduced standards suggest that increasing financial support from 14 % to 16 % and 18 % does not suffice to encourage a deep retrofit for most building owners (Neuhoff 2011).

According to the survey of Neuhoff et al (2011), in addition to offering higher levels of support for deep retrofits, the design of the loan application process is important. Households are required to commit to an energy performance level and consult with energy auditors before and after the application for KfW loans. Households with KfW support reported that they pursued all of the initially envisaged thermal improvements, while other households often reduced the scope of the thermal retrofit during the decision-making process.

There are also different regional subsidy programmes in the federal states. For example, Hamburg offers subsidies for the energy efficient retrofit of apartment buildings. Besides subsidies for technologies, there are also subsidies for the consultancy on energy efficient retrofit measures. The on-site counselling of the Federal Office of Economics and Export Control subsidises the costs paid for the consultant. It reimburses 50 % of the costs associated with the energy retrofit audits, with a maximum support level of 360 € per building. In 2010, it supported 20 000 energy audits. (ENPER-EXIST 2006; Neuhoff et al. 2011.)

Schemes certifying the capability of a firm to implement deep retrofits are not only necessary to help households choose a firm, but they also create incentives for firms to send their staff to training. This is particularly important in the building sector due to high staff turnover and difficulties with finding time to send staff to training during tight project deadlines. Certification schemes can also help to assure households that firms have the expertise needed to provide comprehensive and independent advice on deep thermal retrofits, thus increasing households' trust in the information provided by contractors. (Neuhoff et al. 2011.)

Putting social situation and lifestyle orientations together, one can identify typical groups of homeowners. (Stiess et al. 2009b). According to empirical studies (Stiess et al. 2010), the house owners in Germany can be divided into five different types according to their attitudes towards energy efficiency refurbishment: type 1: convinced energy saver, type 2: sceptics, type 3: maintenance focused, type 4: indifferent and passive and type 5: optimise property. The largest group of these types are the *sceptics*, by 29 %. A quarter of homeowners are *convinced energy savers* and one fifth intends to *optimise their property value*. *Indifferent and passive* by 14 % as well as *maintenance focused* by 12 % form smaller groups.

The main barriers to energy renovations can be summarized as follows:

- According to one of our interviewed experts, the most important barriers for residential sector and especially for owner-occupied single-family homes are:
 1. Financial issues combined with life situation, age and subjective attitudes towards e.g. taking a loan. For example, over 50 % of owner-occupied home owners are over 60 years of age, often pensioners. A general problem is a lack of financial resources.
 2. People often underestimate the gains they would have from an energy refurbishment project; consequently they also overestimate the efficiency of their own building. The barrier is thus the lack of understanding and lack of actual information about their own homes.
 3. Cost effectiveness and the uncertainty about reaching the energy saving goal as well as fear of disappointment for not realizing the expected result are important barriers in engaging in energy refurbishment.
- There are specific barriers that come about if the owners are elderly people:
 1. Elderly owners are in general reluctant to take any loan, i.e. are afraid of incurring debt. Also, the banks are much less keen giving them any loans. Thus, they have fewer possibilities to have access to capital.
 2. They may sometimes have only little interest to invest to their home; “who cares about the last ten years” –attitude.
 3. Elderly people also often apply an evolutionary renovation approach, which leads to lock-in effects and the efficiency improvement potential to be used only to a limited degree.
- In general with the residential sector, people tell further their negative experiences to their friends, acquaintances and neighbours much more often than if the retrofit was successful, which discourages others to take action.
- According to our expert interviews, access to information is now better than some years ago: there are energy audits, consultancies etc. but the availability of information depends on the region and on the owner.
- Barriers are also the missing interests and lack of motivation because of discomfort during the renovation.
- To remove the barrier or simulate renovations:
 1. 1. provide financial schemes not only based on bank loan, because people over 60 are reluctant to take on loan, rather there should be subsidies i.e. tax based
 2. 2. provide information on own building. Expert advice is the most important or effective way, people do not trust the certificates. It should be brought into their homes what could be done in their places, individual advice
 3. 3. legal regulations would not bring anything. legislation already exists, but there is no party in Germany who enforces it, people are aware of this and they know there are no consequences even if they do not follow the legislation
- Genuine uncertainties regarding cost effectiveness: Conflicting information and mistrust of information, heterogeneous outcomes and uncertainty concerning measurement and verification of energy saving pose a critical barrier hindering energy refurbishment for two types of homeowners: the *sceptics* and *indifferent and passive*. These types of households are anyway very sceptical and therefore uncertainty plays a decisive role for them.
- Financial barriers: Unwillingness to incur debt is a critical barrier for all kinds of house owners except for *the convinced energy saver*. The *convinced energy savers*, *maintenance focused* and *indifferent and passive* are critically hindered from energy retrofit by the access to or the cost of capital. The *maintenance focused* and *indifferent and passive* types of house owners also face a critical barrier in the long payback time of the investment as well as in high initial costs. The latter is also a critical barrier to the *sceptics*. The low or uncertain resale value of property pose a critical barrier to *sceptics* and *indifferent and passive* types of home owners.

- Organisational problems: the *sceptics* and *indifferent and passive* home owners are hindered by the short timeframe of decisions, for example due to a short expected occupancy. The *indifferent and passive* lack the general interest and the *sceptics* cannot be convinced in a short time.
- Lack of information and skills does not pose a critical barrier to the other types of home owners but for the *indifferent and passive* home owners it poses a critical barrier due to their lack the general interest.
- Transaction costs: high information search costs pose a critical barrier to *sceptics* and *indifferent and passive* types of home owners.
- Other: inaccurate evaluation of existing energy standard of a building (efficiency standard perceived to be much better than it actually is) is a critical barrier to *sceptics*, *maintenance focused* and *indifferent and passive*. Preference for "visible" measures (e.g. new bathroom) forms a critical barrier to *sceptics* and *maintenance focused* home owners. Discomfort due to construction phase (dust, noise etc.) is a barrier to *sceptics* and *indifferent and passive* types of home owners.

One of our interviewees described the groups of home-owners in context of decision making:

- Type 1 "convinced energy saver": the most likely person to take on a loan, uses advice, but wants to make up his own mind.
- Type 2 "sceptics": often older people, who need someone to tell them what to do, not pleased about loans, looking for skilled help.
- Type 3 "maintenance focused": does not make large investments, business as usual kind of type.
- Type 4 "indifferent and passive": this type of a person does not trust experts.
- Type 5 "optimise property": young people, who have newer homes "do it yourself types".
 - For single-family home-owner types the payback time would be a psychological one not a monetary value. People would not calculate the return on investment but would expect it in non-monetary form.
- The interviewees would warmly welcome more turnkey solutions. If they would be available, it would make the investment easier for all home owner types.
- One of the experts that we interviewed had suggestions about what would stimulate energy renovations in general in all single-family home-owner types:
 - More regulatory framework that is obligatory, now there are only a few obligatory requirements.
 - To have a long term renovation schedule: the building owner should pay a fee if his building shows low energy efficiency and a grant or supplement if the efficiency level is good. The energy consumption should be decreasing over time (i.e. reducing marginal consumption rate).
 - New financing mechanisms should be created for elderly and low income people including risk funds
 - More information more easily available.
- According to our expert interviews, the most important criteria for all types of single-family home owners are the initial costs and improved value of property. The most important for all is also the timing vis-à-vis previous renovation or the necessary maintenance, except for the type that optimises property. Recommendations by experts are also most important for all, except for maintenance focused home-owners. Return on investment is not an important decision criteria because private people usually use more static economic calculation as a basis for decision.
- For private owners in general, the ease of renovation as decision criteria is not that relevant, because owners do not know the "easiness" beforehand. A convinced energy saver would most likely try to increase his energy efficiency even if the renovation is not easy to perform. For the sceptics other criteria are more important. Eventhough there would be good quality service available he would not start retrofit based on that.

- For the *convinced energy saver*, the most important criteria are also the environmental considerations and expected future regulations. These criteria are important as drivers for decision making only for this group of owners. Equally important are savings in energy costs and improved comfort. Improved social approval or status is most important as decision criteria only for this group of home owners and for public buildings.
- For the *sceptics*, the most important criteria are also the payback time of the investment and energy cost savings. Widely used solutions and improved comfort also motivate the *sceptics*.
- For the *maintenance focused*, most important are also short payback time and the quick installation. Equally important are the ease of maintenance, widely used solutions and improved comfort.
- The *indifferent and passive type* of homeowner value also quick installation and the ease of maintenance.
- The home owner type *optimising property* also pays the most attention to short payback time and to the quality of service available.

9.2.2. Rental multi-family buildings

Rental multi-family buildings (commercial or co-operative) make up 23 % of the floor space of the building stock considered here. In Germany, living in a rental apartment is very widespread. More than a half of the population live in rented homes. Private landlords are the single largest owner group of rental multi-family buildings by circa 12 %. Almost 7 % of the buildings are owned by professional, non-commercial housing cooperatives. The smallest share, a little less than 5%, belong to professional, commercial housing cooperatives.

There is a legal possibility to transfer investments into rent in Germany. The rent can be raised by 11 % of the total investments from the year the modernisation has been carried out. However, the level of rent needs to be harmonised to the local comparative rate in the following years. This is the case for all owner types of rental multi-family buildings. (ENPER-EXIST 2006.)

In case on multi-family rental buildings owned by private landlords, housing co-operatives or housing companies, the tenant can legally influence the decisions to a certain extent. There are limits of the legal obligation of the tenant to tolerate the modernisation measures. In a rare case of mixed partly rented and owner-occupied buildings the owners can influence the decisions but also the tenants to a certain extent. (ENPER-EXIST 2006.)

The main barriers to energy renovations can be summarized as follows:

- According to one of the expert interviewees in case of rental multi-family buildings a very important difference is whether or not the building is privately or professionally managed, not so much whether the owner is a private person or a company. Another interviewee on the other hand pointed out that it is quite important whether the privately owned rental multi-family building is a merely rental house or whether the owner lives in one of the apartments himself. Decisive for professionally owned rental multi-family buildings is whether the owner is a company with a strong local perspective, who is interested developing the area and the building further with a strong sense of responsibility, or whether the motivations of the company are purely financial and for making profit.
- Privately owned rental multi-family buildings belong often to older people who have the building as their "Altersversicherung", insurance for the old-age. High initial cost is the most important barrier for these people, because they do not have so much access to capital and are reluctant to take a loan
- Landlord-tenant dilemma is also significant in case with rental multi-family buildings. One of our interviewee pointed out that especially in case of privately owned buildings

- it is more of a communication problem as it is not easy to communicate to tenants that there is a renovation coming that will influence the comfort and possibly also raise the rent. The importance of the new renovation might be questioned altogether. There is also a lot of administrative work, like making new rental agreements; it is much work for a private person especially as there is often lack of expertise in management. Professional firms have specialists for the building management. Thus, there are high administrative barriers for energy refurbishment in case of private owners, as all the trouble must be gone through.
- A specific barrier that has more importance for private owners is that through refurbishment some costs emerge that cannot be put into rent increase.
- Also a fear for disputes and disagreements that might even lead to court is a barrier.
- Lack of information is a barrier; owners are not well enough informed about the energy issues (what to do and how).
- One of the interviewed experts noted that for professionally managed rental apartment buildings the economic aspects pose the most important barriers:
 - The professional managers pay much more weight on financial issues and especially they have strict rules for short payback times.
 - There is uncertainty whether the owner can include all incurred costs to the rent and whether people are willing to rent the apartment with increased rent?
 - The owner company also wants to make profit with the building, not just gain costs back. This is especially a problem in the eastern part of Germany and some parts of the north where there is low demand/high supply on rental apartments. Professional managers are often more worried about being able to refinance their investment in low demand areas (where there are a lot of apartments available and less demand, like the north, east and in general areas where the population is decreasing)
- Some other issues that the interviewees pointed out:
 - there is a change in the tenancy law which reduces the barriers a little: tenants have to accept some renovations,
 - when there are support problems from tenants and there should be differentiation of rents according to the income levels ,
 - the in Germany very general heating system based on individual boilers is a barrier for comprehensive energy efficiency refurbishment, but central heating system renovation is often much too expensive.
- One of our interviewees compared privately managed rental multi-family homes with owner-occupied single family homes; the people have the same barriers except that they are even less willing to go through an energy renovation. A barrier might arise due to the way private people calculate the investment costs (short-term). Instead, they should pay more attention to the life cycle of the building investment.
- Another expert remarked that in case of privately managed multi-family building in Germany the owners have usually very small buildings in their possession; there are usually only 4-10 apartments in one building. The private owners are a very heterogeneous group and much spread across population when it comes to profession or background.
- There is a high share of craftsmen as these small owners, who see the building as a security or insurance in old age. These craftsmen are experienced in their own area of expertise but do not know about the other areas and therefore they improve the building as far as it goes with their own knowledge, but do not want to start renovation in other areas that are out of their expertise. They are often very pragmatic and also “advice resistant”, like one of our interviewee noted. There is a problem that all craftsmen are not well enough qualified to do energy renovations. They often do not work together with other craftsmen, but they just realise their small part regardless of the others. This leads to isolated single measures but not to a complete refurbishment of the building. Therefore, problems rise and even damages to the building. One problem is also that these small owners have little up-to-date information. They act only on own interest and cannot gain any

synergies from experiences with other building renovations like professional managers do. Like in the case of single-family home owners, bad experiences are heard wider and louder than the good ones and therefore some renovation technologies have a bad reputation and an image that they do not function correctly. This is a great barrier for investments, because people hear about these problems, but seldom about successful experiences.

- One of the interviewees mentioned that there is a niche for modernisation reluctant owners. In areas that are not so popular and where the rents are rather low, the private owners of buildings are not interested in doing anything to their building unless they are forced to invest, especially because they have nothing to do with the energy costs of daily energy use. These owners are able to make a profit with the apartments regardless of the low rent because they do not do improvements at all. This is possible only through a high fluctuation of the tenants that stay in a “bad quality, high energy costs” flat only for a short period of time, like i.e. students.
- Thus, conflicting information and mistrust of information are critical barriers for privately owned rental multi-family homes. The same applies for heterogeneous outcomes and uncertainty concerning measurement and verification of energy saving.
- Long payback times are critical barriers for both owner types of rental multi-family buildings. High initial costs and the unwillingness to incur debt are critical for private landlords. Occupant take-back (i.e., tenants will increase comfort level and no savings will accrue) is seen as a critical barrier for the professionally managed multi-family buildings. The same applies for a low or uncertain resale value of property after energy efficiency refurbishment.
- Landlord-tenant dilemma (i.e. the case where the owner of the building makes the investment, thus, bears the cost but the only the tenant benefits from it without having to pay for it) is a critical barrier for both private and professional rental multi-family building owners. Collective decision problem is a barrier to privately owned rental multi-family buildings’ refurbishment.
- Lack of customer attention and interest as well as unsophisticated financial analysis pose a critical barrier to privately owned rental multi-family buildings.
- High information search costs pose a critical barrier to privately owned rental multi-family buildings.
- An inaccurate evaluation of existing energy standard of a building (efficiency standard perceived to be much better than it actually is) is a critical barrier to privately owned rental multi-family buildings. Preference for "visible" measures (e.g. new bathroom) forms and the discomfort due to construction phase (dust, noise etc.) with a conflict with tenants linked to this pose a critical barrier to both private and professional rental multi-family building owners.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- According to an interviewed expert, it is quite important whether the privately owned rental multi-family building is a merely rental house or whether the owner lives in one of the apartments himself. Decisive for professionally owned rental multi-family buildings is whether the owner is a company with a strong local perspective, who is interested developing the area and the building further with a strong sense of responsibility, or whether the motivations of the company are purely financial and for making profit.
- For both types of building owners, a short payback time, timing vis-à-vis previous renovations or necessary maintenance and the ease of maintenance are the most important decision criteria. Payback time is the main criteria to companies.
- For professional owners, the most important is return on investment, which in case of a private landlord is not as important. However, in case of a private owner, for whom the building is only a rental object, then the return on investment is an important criterion for them as well. Especially important it is, if the professional company owns the building mainly for profit reasons. For private owners, the initial cost is very important but in case of an owner who is living also in the building,

the initial cost is not that important. Energy cost savings improves the attractiveness of the home. It is easier to deliver costs to rent but it is not a very important criterion.

- The quality of service available and the quick installation are important criteria for professional owners. Especially the quick installation is a cost factor, because the tenant can pay less rent for the time of the renovation at least in some parts of Germany.
- Widely used solutions are important especially for private renters as they are risk averse.
- Improved comfort is not important in general but in a case where the owner is also living in the building himself then the improved comfort plays an important role in the decision making,
- Recommendation by experts in case of privately managed rental multi-family homes is important as a criterion depending whether the owner trusts the experts. Nevertheless, they would need the expert advice to be able to make correct decisions.

9.2.3 Rented single-family detached and attached houses

Rented single-family detached and attached houses are usually owned by private landlords. Attached houses are usually smaller and more affordable than detached houses. They make up a total of 7.8 % of the share of building stock considered here. As a small and heterogeneous group of the building stock, they are discussed together.

The tenants are interested in reducing their energy consumption costs, but have no real influence on the decision of the owners. Measures that affect the living habits of tenants (like replacing windows or making changes inside the apartment) might not be favoured by the tenants. However, they have to accept some of these measures.

In 2009, a new amendment to a Heat Cost Ordinance (Heizkosten V) allows landlords to increase the consumption based share of the ancillary rental expenses to 70 % giving the tenant an incentive for energy saving. In addition, the tenant has the right to rent cuts in case the landlord does not fulfil the retrofitting requirements. These improvements should in principle lead to higher incentives to invest in energy efficiency improvements in the building. (Groba and Traber 2010.)

The main barriers to energy renovations can be summarized as follows:

- According to one of our interviewees this type of owner is more like the owner-occupied home owner.
 - They are small property owners, not big companies, maybe they get the house as heritage from their parents and have an emotional bond to it
 - The building has a high symbolic value and therefore how the building is taken care of is very important.
- Landlord-tenant dilemma may not be a problem in general, because the owner wants to take care of the building and “does not care” whether there is a direct benefit for himself, but in some cases it is a critical barrier.
- This owner has the same barriers as the private owner of a rental multi-family building except for the collective decision making problems. Thus, conflicting information and mistrust of information are critical barriers. The same applies for heterogeneous outcomes and uncertainty concerning measurement and verification of energy saving.
- Long payback time is a critical barrier. High initial costs and the unwillingness to incur debt are also critical.
- Lack of customer attention and interest as well as unsophisticated financial analysis pose a critical barrier.
- High information search costs pose a critical barrier to privately owned rental multi-family buildings.
- An inaccurate evaluation of existing energy standard of a building (efficiency standard perceived to be much better than it actually is) is a critical barrier. Preference for “visible” measures (e.g. new

bathroom) forms and the discomfort due to construction phase (dust, noise etc.) with a conflict with tenants linked to this pose a critical barrier.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- Financial criteria are obviously very important. For the owners of rented single-family homes the initial cost of investment plays the most important role as well as the payback time, since it has implications to the profitability of the investment decision.
- The timing of vis-à-vis previous renovations or the necessary maintenance is a crucial factor for investment decisions. All renovation must naturally be correctly timed. The ease of maintenance also plays an important role because it is a large cost factor for the building owners.

9.2.4 Owner-occupied multi-family buildings

In Germany, condominiums for a share of circa 7 % of the building stock considered here. There is legislation concerning co-ownership of buildings. In the legislation, renovation measures are divided into changes that have to be agreed upon unanimously, upon by the majority of three quarters of all owners or the simple majority of owners can be made without a specific decision making of the owners (like the running maintenance of the building). To the changes that have to be agreed unanimously belong changes that influence the stability, the security or the architecture of the building, changes that reduce the daylight availability or produce an advantage or a disadvantage for a single owner. Changes that have to be agreed upon by the majority of owners are e.g. renewals or improvements of the heating system or the ventilation system. Measures at the envelope of a building (aiming at improving the energy performance) need to be taken by a 75 % majority. Changes that can be made without agreeing with the owners are new glazing or measures inside the apartment, like e.g. new lighting systems, heating control or internal insulation. (ENPER-EXIST 2006.)

A financial barrier exclusively directed to the association of owners emerges through the fact that the group of co-owners of the building cannot obtain easily additional funding for measures from a bank, as they are not a legal organisation. Therefore, most measures can only be realised if the total investment costs do not exceed the financial reserves maintained for the building. In Germany, the owners of in co-owned apartment buildings have to form a financial reserve so that necessary renewals can be paid. This reserve is however limited to a certain percentage, a fact which restricts the possibilities of taking energy efficiency measures at the building. The annual reserve has to be equal to 1 % of the investment for the new building. (ENPER-EXIST 2006.)

In co-owned buildings with rental apartments an important actor is the property manager, as he is preparing the proposals about energy retrofits for the decision to the owners. Information sources and the national authorities do also have a certain influence on decisions about energy saving investments. (ENPER-EXIST 2006.)

In general, the main specific barrier considering rental buildings is the discrepancy between ownership (investment) and usage of the building (energy cost saving) but in case of owner association the main barrier can become the necessary agreement of all (or the majority of) owners for certain energy efficiency improvement investments. In some cases, insufficient financial reserves provided by the owners and measures that will save energy for some owners only, but have to be accepted by all or by the majority of owners, pose a critical barrier. Measures that only save energy for some of the owners but have to be accepted by all (or by the majority) of the owners will rarely be realised.

The main barriers to energy renovations can be summarized as follows:

- This is the most difficult case, because the owners of these apartments have very high transaction costs. Earlier there used to be very strict regulations, like the requirement that all owners had to agree before anything could be done. Now a 75 % majority needs to accept/agree on suggested

modernisation measures. There are administrative barriers as someone must be the one who organises all and finding an interested person may be difficult. Also financing is difficult, because the apartment owners need to take a loan each individually and not for the whole building as such.

- Also here conflicting information and mistrust of information are critical barriers. Heterogeneous outcomes and uncertainty concerning measurement and verification of energy savings may also form a critical barrier for owner-occupied multi-family buildings.
- Long payback time is a critical barrier. High initial costs and the unwillingness to incur debt are also critical. According to in interviewee initial cost is an important factor because the owners have to pay for everything at once.
- Also in this case the landlord-tenant dilemma may become a problem because there are also mixed forms of occupancy in these buildings. Some apartments are owner-occupied and some are rental. Therefore, there are also collective decision problems that may become critical.
- High information search costs pose also a critical barrier.
- An inaccurate evaluation of existing energy standard of a building (efficiency standard perceived to be much better than it actually is) is a critical barrier. Preference for "visible" measures (e.g. new bathroom) forms and the discomfort due to construction phase (dust, noise etc.) with a conflict with tenants linked to this pose a critical barrier.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- For the owner-occupied multi-family buildings crucial decision criteria are the initial costs as stated above. Return on investment is also very important. Because the owners of the building also occupy it the energy cost savings are also very important as criteria, because the owners themselves would benefit from it.
- Timing of previous renovations absolutely crucial issue: otherwise there is no majority to support the refurbishment. Widely used solutions are also very important because employing them it usually reduces costs and makes later maintenance or repair activities easier and less cost efficient. Also they reduce the perceived risk of the renovation.
- Improved comfort and improved value of property are also very important decision criteria in this case, because the owners benefit from the actions themselves.
- Recommendations by experts are most important because the owners need somebody who is very reassuring to convince the majority of owners.
- According to our interviewees, private owners of buildings or condominiums should engage a professional building manager, because of synergies, experience, information about subsidies etc. There may be managers as owners of the flats, but they do not know enough about energy refurbishment, eventhough they would be able to otherwise manage the renovations. There should be energy consultant specialized to these cases (like a contractor) to convince all parties of the need of energy investment.
- An improvement would be to set up a risk fund so that people could apply for financing for the whole building even if not all inhabitants will or can pay for it or will pay back the loan.

9.2.5 State- and municipally owned public buildings

State- and municipally owned public buildings form 4.5 % of the floor area of the building stock considered here. The number of public buildings is very high, there are about 190,000 buildings owned by the public, e.g. by communities, the state, or similar (Steinbach et al. 2010).

Governmental buildings are set under stricter requirements than other buildings. The buildings of the federal government in Berlin have to fulfil the requirement to perform 30 % to 40 % better than stipulated by the EnEV requirements. This applies for both new and existing buildings (decision of the Bundeskabinett/ Federal Cabinet as of 11/12/1991). In addition, there are several city administrations that demand a better energy performance quality for their own buildings and for buildings that are going to be

built on their ground. (ENPER-EXIST 2006). There are 37 federal government-owned and occupied buildings in Germany (EurActiv 2012).

Considering public buildings in municipalities, renovations are mostly realised because of building defects or damages; sometimes also because the function of the building is changing. These types of renovation work do not originally focus on energy efficiency; mostly, they are managed by the planning department of the community. In some community administrations, there is a special department dealing with energy consumption and environmental impacts. If this department (or a similar group within the planning department) is involved in the design phase and more, the energy efficiency will be included as a renovation side effect, at least. (ENPER-EXIST 2006.)

Many communities are facing the problem that those who are responsible for taking decisions on renovations only see their budget and will neither obtain any improvement in the financial situation (part of pay-back or similar) nor any feedback on the results. There are separate budgets for renovation investments and life-time energy costs. This is why communities realise those renovations that are most urgent, on account of non-energy related reasons. (ENPER-EXIST 2006.)

However, in the beginning of 2007, the German 'KfW Promotional Bank' has launched a programme that is targeted at communities, offering cheap loans for energy efficient retrofits to be performed at publicly owned buildings. Communities may also start public-private-partnership- (PPP-)contracts for improving the energy efficiency of their buildings. The PPP company will analyse the building and realise cost-efficient measures to reduce the energy consumption. The investment and labour costs of the PPP company will be covered by the reduced energy costs, hence there are no investment costs for the community. (ENPER-EXIST 2006.)

Some communities have started to build revolving funds. For that, a limited amount of the budget is set aside for energy efficiency measures to be performed at community-owned buildings. The fund pays the required investment and this money will be paid back from the energy costs saved due to the successful measures. Once the total fund has been spent, the community has to wait for the paybacks before a new energy efficient retrofit measure can be started. In this way, control of the money spent is ensured. (ENPER-EXIST 2006.)

In the case of public, non-residential buildings the decision makers should be trained to acquire a broader view: Making them realise that the budget of the community is more than their part only, investment in the energy efficiency will have a payback, energy efficiency is important not only financially, but also for the environment and for the security of the future energy supply. This can be enforced by internal orders issued within the community.

The main barriers to energy renovations can be summarized as follows:

- Public budgeting practices are a barrier: the federal state controls the building and decides for the refurbishment. The tenant (usually another public institution) pays the energy bill. It is a kind of landlord-tenant –problem even though finally also the public agency renting the public building gets its finances from the federal state. Our interviewee suggests that the budget practices should be reorganised.
- For public buildings a special barrier emerges from the fact that there are only short phases when there is money available and the renovation are limited to these times. This leads to partial measures.
- One of our interviewee pointed out that air quality in the public buildings much neglected. There should be much more invested in controlled air conditioning, especially in schools. There are no regulations about the air conditioning in renovation, but in new buildings there are. This is because decision makers do not have any understanding for air conditioning; only things that they are acquainted with are humidity and mould. There seem to be high barriers to improve this, even though it would lead to improvements in the working environment and to a better concentration. There would be a big demand for expert advice in air conditioning in public buildings.

- For public buildings high initial costs poses a critical barrier, because the public sector is strongly regulated with their previously set budgets. The budgets have limits and they cannot be exceeded.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- For public buildings the timing vis-à-vis previous renovation or necessary maintenance is the single most important decision criteria. Refurbishments can be made in connection with the budgeted investment cycle. Otherwise there is no financial means to do them
- Social approval or status is also an important criterion especially due to the politically set exemplary role of the public sector.
- Environmental concerns play only a secondary role in case of public buildings, even though there are ambitions to make them shiny examples for environmental investment in some German cities (ENPER-EXIST 2006).

9.2.6 Office buildings

Office buildings amount to about 5 % of the building stock considered here in terms of floor area. According to the ENPER-EXIST (2006) study rented office buildings are an important part of the non-residential building stock. There are two main owners. First, there are real estate investors (like insurance companies and pension funds) renting out office buildings for the purpose of financial profits. The tenants define the office building they use as a facility necessary for their primary process. They do not need to invest in a building and are able to use their capital for their primary business. Their housing needs can vary through the years and the office space has to comply with these changing needs. During uncertain economic times, the share of real estate in an investor's portfolio usually increases. In general, the share of real estate in investment portfolios is reasonably consistent.

The real estate investor is the owner of the real estate. The investor acquires a building and subsequently rents out, manages and exploits the building during a relatively long period of time. His aim is to realise a profit on his investment. This category of renters, including insurance companies and pension funds, is the most important. They are motivated by realising financial benefits from their building stock, they focus on a short timeframe of 3 to 5 years and, at present, their knowledge on energy saving is usually limited.

Secondly, there are large organisations with offices at many locations (banks, insurance companies, semi-governmental organisations, etc.) that decide to outsource their real estate management to a separate business unit with the specific objective to provide cost efficient office buildings of a good quality. In general, these companies operate mainly or exclusively for the mother company by renting out the offices and thus having much more extended time frame for real estate management; far over 5 years. This is a smaller section of the office building stock than the first category.

The real estate managers are motivated by providing efficient office buildings of a good quality. They typically focus on a more extended timeframe, like far over 5 years. They can be characterised by high level of professionalism, sound knowledge of the exploitation process and attention for energy and environmental management. (ENPER-EXIST 2006.)

In many cases, the actual building exploitation of the stock is outsourced to separate organisations. Often there is a division in the technical approach of the building management and the strategic approach. The latter is mainly based on financial considerations. The owner of the buildings negotiates contracts with building exploitation organisations and is in the position to determine the conditions, which form the basis for the building exploitation and the execution of maintenance and renovation activities. The owner and possibly the manager in general have a professional attitude to their approach of the building stock and are well aware of the financial aim of the organisation, which is: making profits. Investments always are linked to either increase of the value of the property or increase in the profits from rent or decrease of the exploitation costs as far as this is beneficial to the renter.

Investing in energy saving is mainly looked at from the point of view of financial benefits. Knowledge and advice on energy saving are sometimes present to a limited extent with this type of customer. This means that additional knowledge is required, in which cases non-energetic benefits will be addressed. When considering taking energy saving measures, the balance of cost and benefit plays an important part, not only for the owners, but for the users as well. More insight in the opportunities for a transparent discussion on the division of cost and benefit is an important element in the decision making process. In general, energy saving measures are judged on the bases of investment versus saving in energy cost, thus leaving out relevant additional benefits of energy saving. It is, therefore, important to clearly state, which negative or positive side effects come with the energy saving measures, e.g. an improvement in comfort as a side effect of a certain measure is an important factor in such a discussion.

An important barrier is the awareness/willingness/interest of the actors on all management levels (strategic, tactical and operational) concerning the possibilities of energy saving. Energy saving is defined as a separate issue that makes things complicated. It is being judged on the basis of a too narrow cost benefit perception. The owner and tenant have split incentives of energy saving due to the fact that the owner invests and the tenant primary gets the benefits. (ENPER-EXIST 2006.)

The main barriers to energy renovations can be summarized as follows:

- According to some of our interviewees, this group is similar to professionally rented multi-family buildings. They have similar structure but more incentives due to reputation.
- For office buildings most important barrier are long payback times and high initial costs. Also the low or uncertain resale value of property is a very important barrier, because office buildings are often owned by real estate investors that are investing to these buildings to make profits.
- A barrier is posed by the landlord-tenant-dilemma as office buildings are very often rental buildings; almost all SME's have their business in rental buildings.
- The interviewed experts suggest that this group should be subject to quite tough regulatory requirements so that any energy improvements will take place.
- The short time frame of decisions (e.g. due to short expected occupancy) is a critical barrier for office buildings.
- Preference for "visible" measures (e.g. new bathroom) forms and the discomfort due to construction phase (dust, noise etc.) with a conflict with tenants linked to this pose a critical barrier to office buildings.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- Return on investment is the one most important factor when deciding about the energy efficiency investment in case of office buildings. The energy cost savings are already included in this calculation and as such do not usually act as a single decision criterion.
- The quality of the service available as well as quick installation are important decision criteria. It is important for the office building owners to get the work done fast and without the risk of delays so that the office building can be used efficiently as offices and that it does not pose large inconvenience for the everyday business of the tenant.
- Life time and risk considerations are for the office building owners the critical decision criteria. The timing of the investment decision is driven by the need for necessary maintenance. Components and technology, like air conditioning, has more significance in case of office buildings than for other building types because their share of the operational costs is much higher and therefore the need of the technical renewal has implications to other investment decisions. For office buildings widely used solutions and ease of maintenance are closely linked together and also have some significance even though their role is not decisive.

9.3 Discussion on barriers and drivers of energy renovations

In general, the refurbishment measures are usually quite complex, which might prevent owners from starting a retrofit process. Also the circumstances vary in which people are. Therefore, the investment decision is rather a combination of many factors than a single motivation. (See Stuess and Dunkelberg (2012) for more about specific circumstances.) Still, there are barriers and decision criteria that emerge more often than others (Table 9.2).

Lack of knowledge on available technical solutions and their saving potential still seems to prevail among the population (Huber et al. 2011). The uncertainty concerning the results is closely linked to the complexity of renovation and circumstances as well as lack of trust in involved parties or experts. There is uncertainty about i.e. how is the energy advice realised. How much money does it take? How much CO₂ would be saved? When it comes to architects or craftsmen, there is sometimes lack of skills or qualification, which might lead to a failure of the refurbishment. The market is not transparent, which means for the building owner that there is lack of actual and up-to-date information. (Kraus 2011.)

Lack of information and skills forms thus another general barrier for energy refurbishments. Novikova et al. (2011) have studied information tools (e.g. energy performance certificates, energy auditing tools, online advice tools, local leadership programs etc.) for energy demand reduction in existing residential buildings and have found that households trust information more if it is provided by experts rather than by internet platforms. Also, tools that signal and ensure the quality of experts are essential for households. Information tools help to catalyse investments in household energy efficiency. Studies show that innovative social marketing campaigns like in Hannover-region the “Gut beraten starten” –campaign are very successful and effective communication tools (Stuess and Dunkelberg 2012). Many studies suggest that building networks of different stakeholders, like energy advisers, craftsmen, authorities etc. is essential in giving more people an incentive to start refurbishment (see i.e. Kesternich 2010, Stuess and Dunkelberg 2012).

The experts that were interviewed for this working paper listed some issues concerning the possible problems and missing skills of craftsmen in updating their training:

- Craftsmen may not be installing the equipment like the producers require, which might lead to wrong installation or even damage to building.
- Craftsmen do not work with each other in good understanding and therefore they do not understand the work of the others and the relevance of the solutions, which might lead to energy efficiency losses or even damage.
- Support programs to educate the craftsmen work better if the geographical area is not too large. In Hannover and Bremen for example, there is a well-working certification system for craftsmen due to a suitable size of the area.
- There are problems in bigger areas, because the political unity is missing, the critical size is exceeded or the mechanism becomes too big, especially if the political interests are not well understood.

A common barrier is that the building owners face difficulties in financing refurbishment measures. This can be tackled with subsidies, grants or taxation. We can see from the table below that high initial costs and unwillingness to incur debt are critical barriers to most owners. Long payback times are almost as common barriers as the high initial costs. In Germany, also the landlord-tenant dilemma is a critical barrier because the landlord can transfer only 11 % of the investment costs to rent in the first year and later the rent must be harmonised to the general rent level, and only the tenant gets the benefits for reduced energy bill. According to Huber et al. (2011) the public support schemes play a crucial role in making refurbishments affordable for the building owners. Local embedding of projects seems to be important as well as regulation stimulating comprehensive retrofitting projects.

The owner groups that experience the most barriers are the indifferent and passive single-family homeowner/occupants and the private owners of rental multi-family buildings. They face financial barriers, organisational problems and genuine uncertainties regarding cost effectiveness. There are also a lot of barriers in the way of energy refurbishments in case of rental single-family owners and the associations of owners.

Table 9.2. Most important barriers to energy renovation for the different owner groups

GERMANY	Single-										
BARRIERS	Type 1: convinced energy saver	Type 2: skeptics	Type 3: maintenan ce focused	Type 4: indifferent and passive	Type 5: optimize property	rental multi- family buildings, private	rental multi- family buildings, professional	rental single- family homes	association of owners	public buildings	office buildings
Genuine uncertainties regarding cost effectiveness											
Conflicting information, mistrust of information											
Heterogeneous outcomes											
Uncertainty concerning measurement and verification of energy saving											
Financial barriers											
High initial costs											
Long payback time											
Access to/cost of capital											
Unwillingness to incur debt											
Occupant take-back (i.e., tenants will increase comfort level and no savings will accrue)											
Low/uncertain resale value of property											
Organizational problems											
Landlord-tenant dilemma											
Collective decision problems											
Short timeframe of decisions (e.g. due to short expected occupancy)											
Public budgeting practices											
Lack of information and skills											
Lack of customer attention and interest											
Lack of customer knowledge											
Lack of reliable advice											
Unsophisticated financial analysis											
Transaction costs											
Lack of skilled service providers											
High information search costs											
Switching costs, concerns over disruption											
Risks of failures in renovation											
Other											
Inaccurate evaluation of existing energy standard of a building (efficiency standard perceived to be much better than it actually is)											

Preference for "visible" measures (e.g. new bathroom)		red	red	orange	red	red	red	red	orange	red
Discomfort due to construction phase (dust, noise etc.) + conflict with tenants linked to this		red	orange	red	orange	red	red	red	white	red

red = critical barrier, orange = contributory barrier, white = not a barrier.

Source: Stieß et al. (2010), Stieß et al. (2009b), Bürger et al. (2011), Technomar (2005), VdZ (2011), BMVBS (2007b).

In the table about the decision criteria (Table 9.3), we can see that the single most important decision criterion is the timing vis-à-vis previous renovations or necessary maintenance. According to one of the experts that we interviewed, this is also linked with the question: how to reach potential customers? Some people are searching for information themselves or some can be reached in connection with other offerings. There is an opportunity factor here that is the most important: in what shape is the house of the person in question at that moment. There are thus basically two kinds of people: those who have renovation plans and who are under pressure because their house must be refurbished or otherwise it might even be damaged and those who are reached in the middle of everyday life and who usually have no pressure. The influence of advice is smaller among people that are reached through other channels than through their own active searching. Home-owners who are not under pressure take more time to start renovation. Consequently to above where it could be seen that high initial cost is a barrier, here we also see that initial cost is a decisive criteria for refurbishment.

Even though the attitudes toward environmental issues, climate change and nature conservation are quite positive in Germany, environmental considerations and expected future regulations are not important as decision criteria for any stakeholder group except for convinced energy savers. There are however studies that suggest that a growing concern over increasing energy prices is likely to make energy efficient retrofits more attractive (Huber et al. 2011).

Table 9.3. Most important decision criteria for the different owner groups

GERMANY	Single-family home-owner types					rental multi-family buildings, private	rental multi-family buildings, professional	rental single-family homes	association of owners	public buildings	office buildings
	Type 1: convinced energy saver	Type 2: sceptics	Type 3: maintenance focused	Type 4: indifferent and passive	Type 5: optimise property						
Financial											
Initial cost											?
Payback time											?
Return on investment											
Energy cost savings											
Ease of renovation											
Quality service available											
Quick installation											
Turnkey solutions available											?
Lifetime and risk considerations											
Timing vis-a-vis previous renovations /necessary maintenance											
Ease of maintenance	?										
Widely used solution	?				?						
Other benefits											
Improved comfort											
Improved value of property										?	?
Social approval/status		?				?		?			
Environmental/societal motives/pressures											
Environmental considerations											
Expected future regulation			?								
Recommendation by experts										?	

Source: interviews and literature as presented above.

10 Italy

10.1 General overview

In Italy, the building stock is fairly old. According to Ruggieri et al. (2007), about 75% of the buildings were built before the introduction of any kinds of energy performance standards. A significant portion of the buildings are more than 50 years old. There is a wealth of historical buildings that are widely appreciated and protected (Nigro and Nigro 2011). Hence, renovation is a growing business in Italy.

In recent years Italian national and regional governments have been active in promoting energy efficiency and renewable energy (Zabot et al. 2011). Significant measures are focused on the residential sector: feed-in tariffs are offered for photovoltaic systems and 55% tax credits are available for energy efficiency investments (windows or boilers substitutions, walls and roof insulations or even complete building refurbishments). In some individual provinces, also low-interest loans are provided (Zabot et al. 2011).

Energy performance standards in the national building code apply to new buildings and the renovation of buildings with an area of more than 1000 m² (ENEA 2009a). New buildings have an energy performance index threshold, and must have external shielding systems, 50% of primary energy consumption for water heating from renewable sources, PV panels to produce electricity, and connection to district heat if available (ENEA 2009a).

Moreover, the governance system in Italy is highly decentralized. Regional and local authorities have significant responsibilities for urban, energy and even climate policy. Some regions and municipalities have implemented their own building codes, energy standards and energy performance certification schemes, which are more ambitious than the national standards, and several regions and municipalities have introduced ambitious promotion and incentive schemes for energy investments in buildings (Ruggieri et al. 2011; Zabot et al. 2011).

Italy also has a system of energy saving obligations for major energy providers. According to ENEA (2009), the white certificates are released by GME (Getore dei Mercati Energetica), after authorization of Regulatory Authority for Electricity and Gas, which verifies the achievement of energy savings. Energy efficiency projects can (and often are) also carried out by ESCos (ENEA 2009).

Energy performance certificates (EPCs) are mandatory for new buildings, sale and rent of a home or dwelling (advertising of real estate ads), total renovation of a home, request for the 55% tax deduction and incentives for PV systems, signing of a new energy supply contract (Bevini 2010). However, the legislation allows for some loopholes, especially concerning the use of certified experts (EC 2012), and the application of the national principles is referred to the regional authorities. In this context, several Regions (e.g. Trento e Bolzano, Lombardia, Piemonte) have issued their own EPC requirements, which are more demanding than the national ones (Bevini 2010), and other Regions have not yet implemented its own EPC scheme.

Italy is the least energy-intensive economy in Europe, but a large weight is placed on energy efficiency policy due to the large share of import of energy and the ensuing high cost per energy unit (ENEA 2007a). Renovation of buildings is also a major industry (ENEA 2007b; Ruggieri et al. 2007). However, there are still several challenges ahead for comprehensive renovations to become widespread throughout the country (Ruggeri et al. 2007).

Table 10.1 presents the major Italian building owners and decision makers by building type. Most of the housing stock in Italy is owner-occupied. The share of rental and particularly social rental is very small. The major owners, their decision structures, and the main barriers and drivers for energy renovations are then presented in the next section.

Table 10.1. Major owners and decision makers for residential, public and office buildings

Building and owner type	Share of total building area, %	Decision makers and types of owners
Single-family detached		
Owner-occupied	15,5	Owner (private persons)
Rented	1,5	Owner (private persons)
Single-family attached		
Owner-occupied	7,9	Owner (private persons)
Rented	1,1	Owner (private persons)
Apartment buildings		
Owner-occupied	17,5	Collective decisions of owners
Private rental	9,0	Collective decisions of owners
Social rental	0,6	Owner: Local authorities, public social housing organizations etc.
Public buildings		
State	8,8	Presidency, parliament, ministries, agency of the state property
Local government		Regions, provinces and municipalities
Commercial office buildings		
Owner-occupied	1,4	Owners (companies)
Rental		Professional property management companies
Other	36,7	
Total	100	

Source: Calculated from 2001 IT census (ISTAT), considering the housing units occupied by residents

10.2 Barriers and drivers of energy renovations among major building owner groups

10.2.1 Single-family homes

Both detached and attached single-family homes are discussed here together, as the barriers, drivers and decision criteria are largely similar. We focus on owner-occupied single-family homes, which amount to about 23% of the total floor area in Italy. Rented single-family homes are marginal and are not discussed in detail here²⁰.

Owner-occupied single-family homes are very diverse in terms of owners' socio-economic characteristics. They consist largely of poorer people in rural areas, middle-class people in suburban areas, and affluent people in urban areas. There is also a large regional difference: single-family homes amount to 40% of all residences in the South but only 17% in the industrialized North (Tosi and Cremaschi 2003).

A common feature, however, is that the owners make decisions on their own. Their decisions can mainly be influenced by the regional and local governments through specific obligations. Home owners can be stimulated to make energy investments through financial means, such as the 55% tax deduction on

²⁰ Rented single-family homes are only about 2,6% of the total building stock. These buildings are mainly owned by private persons (Rondonelli and Veronese 2010), who make their decisions on their own. The are in many respects similar to the owner-occupied homes. There are obvious differences in terms of landlord-tenant dilemmas and timeframes, but these are not discussed here in detail.

renovation costs. This applies to such interventions as thermal insulation, double glazing windows, efficient boilers and air conditioners, and solar panels (ENEA 2009a).

According to the Ministry of Economic Development (2012), there are several barriers to the adoption of energy efficient solutions. For small consumers, the most important ones are high initial investment costs, low awareness of the potential savings and difficulties in accessing incentives. In more detail, the main barriers to energy renovations in single-family homes mentioned in the literature and in our interviews can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness:** Conflicting information and mistrust, and uncertainty concerning measurement and verification of savings are rated as critical. Even experts have different views on what are the most suitable types of renovations (Contaldo 2012).
- **Financial barriers:** Several financial barriers are critical: high initial costs, long payback times, access to capital and an unwillingness to incur debt. High initial costs are reported as a critical barrier by Beillan et al. (2011), Zobot et al. (2011) and Ministry of Economic Development (2012). The high cost and difficulties of accessing capital are mentioned by (Ruggieri et al. 2007) and a general aversion to incurring debt by Tosi and Cremaschi (2003).
- **Organizational problems** are not barriers for owner-occupied homes, where decisions are made within the family. However, the landlord-tenant dilemma and short time-frame of decisions can be barriers for owners of rented single-family homes.
- **Lack of information and skills:** In this category, lack of customer knowledge, lack of reliable advice and unsophisticated financial analysis are reported as critical barriers. This is supported by data from Beillan et al. (2011) and the evaluation by the Ministry of Economic Development (2012).
- **Transaction costs:** Two barriers are rated critical in this category. A lack of skilled service providers is mentioned in several reports, which is compounded by the fragmented nature of the renovation services market, which consists of large numbers of micro-enterprises (ENEA 2007b; Economidou et al. 2011). This adds a further difficulty to high information search costs (Beillan et al. 2011), which is also rated as critical. Concerns over disruption and risks of failure in renovation are rated as lesser barriers.

Major drivers for energy renovations by single family home owners are likely to include the age and poor state of building stock (Nigro and Nigro 2011), a desire to upgrade and enhance the building (Beillan et al. 2011) and the high cost of energy (ENEA 2007a). The 55% tax deduction is reported as having been a great success in promoting renovations (Beillan et al. 2011; Neuhoff et al. 2012). However, according to Beillan et al. (2011), there are differences between the northern and southern parts of the country. The tax deduction is much more used by inhabitants of the North than of the South of Italy; moreover, architects and engineers in Northern parts of Italy are more active in promoting energy efficient solutions.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for single-family home-owners:

- **Financial criteria:** Energy investments imply significant upfront costs (ENEA 2007a; Beillan et al. 2011), hence initial costs are a dominant criterion, followed by payback times and estimated returns on investment.
- **Ease of renovation:** The availability of good quality service is estimated as having medium importance, whereas quick installation and the availability of turnkey solutions are relatively less important for single-family home-owners, as is the case in most other countries.
- **Lifetime and risk considerations:** Timing is relatively important, especially concerning impacts on the yard in the growing season. Ease of maintenance and the availability of widely used solutions have medium weight in single-family homes. This is logical as many single-family homes are old and idiosyncratic.
- **Other benefits:** Improved comfort is relatively important (see Beillan et al. 2011). In contrast, improved value of property and social approval or status are not expressed through energy

efficiency actions in single-family homes. They are, however, reflected in improvements to the appearance of the building and the selection of certain types of equipment.

- **Environmental and societal motives and pressures:** Environment is rarely the main motive for energy renovations, but can be a side-benefit (Beillan et al. 2011), hence it is rated as having medium importance. Expected future regulations are less important for single-family home owners, but recommendations by experts can be quite important (Beillan et al. 2011).

10.2.2 Owner-occupied apartment buildings

Owner-occupied apartment buildings (condominiums) make up the largest single category in the building stock. They are typically home to middle-class people in suburban areas and more affluent people in urban areas. Home ownership increases with income, but also the age of the head of the household (Rondinelli and Veronese 2010).

In condominiums, owners make decisions about the building collectively. Decisions about energy investments require a majority of 51% of the value of the building, which is less than for most other types of investments (Ruggieri et al. 2007). However, according to Ruggieri et al. (2007), the rules leave open the possibility for dissenters to move to delay the implementation of decisions with significant financial consequences. As in many other countries, disputes among residents are common at condominium assemblies (Ruggieri et al. 2007). Condominiums with more than four apartments are also required to appoint a building administrator, who has to have professional certification. These are usually companies managing several buildings, but about 10% of administrators are only in charge of one building (Ruggieri et al. 2007). Building administrators manage several responsibilities, of which energy issues are only a small part. Ruggieri et al. (2007) also mention a third party, which can be appointed to take care of heating systems.

The main barriers to energy renovations in owner-occupied apartment buildings can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness:** These relate to the overall lack of consensus in Italy over the best solutions (see above section 10.3.1.1). In this context: conflicting information and mistrust of information and uncertainty concerning measurement and verification of energy saving are rated as critical barriers.
- **Financial barriers** include several critical ones: Initial costs, payback times, access to capital and unwillingness to incur debt are all rated as critical for apartment owner-occupiers, for similar reasons as for single-family homes (section 10.3.1.1). A less barrier can be the low or uncertain resale value of the property.
- **Organizational problems:** Collective decision problems are characteristic to this owner group. Ruggieri et al. (2007) report that even cost-effective renovations can encounter opposition. Different people benefit differently from improvements; moreover, personal antipathies related to past disputes can make decisions difficult. Ruggieri et al. (2007) report on a survey in which 48% of the condominium associations had fairly frequent quarrels and 11% involved litigation. Contaldo (2012) also suggests that difficulties in reaching agreement are one of the reasons why most of the 55% tax benefits have been used for window renovations (which residents can make on their own). Moreover, Ruggieri et al. (2007) also comment that building administrators and heating system managers could have an important role, but do not do so in practice, due to the vagueness of their responsibilities concerning energy consumption.
- **Lack of information and skills:** Lack of customer knowledge, lack of reliable advice and unsophisticated financial analysis are rated as critical. This is based on Ruggieri et al. (2007), who report lack of end-user information, lack of economic rationality and overestimation of extra costs are major barriers. Moreover, Zabot et al. (2011) report that the majority of households who could apply for the 55% tax credit did not do so, mostly because they were unaware of it.

- **Transaction costs:** As in the case of single-family home, lack of skilled service providers and high information search costs are deemed critical barriers, whereas concerns over disruption and risks of failure are lesser barriers.

Improved comfort and energy savings are likely to be the main drivers for energy renovations in multifamily buildings, whereas environmental considerations are usually seen as a side-benefit (Beillan et al. 2011). Moreover, Beillan et al. (2011) suggest that a desire to improve the value of the property can motivate renovations in condominiums. Ruggieri et al. (2007) suggest that the energy performance certificate could be an important driver if accompanied by appropriate recommendations. Overall, the important role of national and regional incentive schemes is well documented (Ruggieri et al. 2007; Ruggieri et al. 2011). The energy savings obligation scheme has some impact in condominiums, mainly in terms of boiler replacements (Ruggieri et al. 2007). Building administrators can promote renovation works. Moreover, they can have an important role in ensuring the quality of refurbishment works.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for owner-occupied apartment buildings:

- **Financial criteria:** Because renovations are made (and financed) collectively, initial cost has slightly less weight than for single-family homes, but is still important. Payback time is more important for the size of monthly charges that residents need to pay. Return on investment is also relatively important.
- **Ease of renovation:** the availability of quality service, quick installation and turnkey solutions have medium weights. However, Beillan et al. (2011) report that renovations are frequently entrusted to architects, including proposal of the detailed solutions to be implemented.
- **Lifetime and risk considerations:** Timing of the renovation is deemed fairly important, as are ease of maintenance and the availability of widely used solutions.
- **Other benefits:** Improved comfort is evaluated as fairly important, improved value of property slightly less, and social approval or status has low importance.
- **Environmental and societal motives and pressures:** These are rated similarly to single-family homes, on the same grounds.

10.2.3 Rented apartments (privately owned)

Private rental apartments constitute 9% of the total building area. Rental homes are more common in urban areas, where they are home to poor or middle-class people, especially younger households (Rondinelli and Veronese 2010). From Rondinelli and Veronese (2010), it can be concluded that most of the private rental apartments are owned by private persons, and they are co-located in owner-occupied condominium buildings. This is supported by data from Tosi and Cremaschi (2003), which indicate that individuals owned almost 3 million rental dwellings, whereas building societies owned less than 300 000, insurance companies about 50 000 and state pension funds about 80 000 rental dwellings.

Since most of the rented apartments are owned by private persons (Tosi and Cremaschi 2003; Rondinelli and Veronese 2010), the barriers are fairly similar to those in owner-occupied apartments (see section 10.2.2). However, in contrast to owner-occupied apartments, occupant take-back and landlord-tenant dilemmas are at least contributory barriers. Considering that the owners of rental apartments are mostly private persons, the drivers for energy renovations are estimated to be the same as for apartment owner-occupiers. Similarly, the decision criteria are expected to be approximately the same as for apartment owner-occupiers.

10.2.4 Social rental apartments

Social rental housing only constitutes a small (0,6%) share of the total building area in Italy. It is defined as dwellings rented on a permanent basis as well as dwellings built or rehabilitated with the use of public funding, rented for at least eight years and also sold at affordable price, with the goal of achieving social

mix (CECODHAS 2012). The social housing stock in Italy has recently been placed under the control of the regional authorities, and it is managed by semi-public housing associations (Riccardo and Pollak 2006). Also municipalities own social rental dwellings, and in some cases they also manage them directly (CECODHAS 2012). The dwellings are allocated by municipalities and rents are based on the income of households and do not reflect the real cost of housing (Milin and Bullier 2011).

As a result, Italian social housing organizations have low investment capacities for maintenance and refurbishment of the housing stock (CECODHAS 2012). Apart from the scarce subsidies available for urban renewal projects, there is no specific funding for energy retrofitting (Milin and Bullier 2011). Often a way for charging a part of renovation costs on the households is to fix the energy bills (on the amount before the refurbishment works) for some years, but not all households pay their bills regularly. Moreover, Milin and Bullier (2011) report that it is almost impossible to get the occupants to vacate their apartment for a certain period for doing the works, as they are afraid of not being able to return after the works. For these reasons, in general, it is very difficult to improve the quality of the public social housings.

According to one of our interviewees, these problems have only intensified in the past years as public investments in general have been severely cut due to the internal pact of stability. The main barriers to energy renovations in social rental apartment buildings can thus be summarized as follows:

- **Genuine uncertainties regarding cost effectiveness:** these are likely to be similar as for the previously discussed owner groups, as the building types are fairly similar.
- **Financial barriers** are very severe for social housing owners. Many social housing providers are struggling financially. They have low investments capacities, and there are no dedicated funds for energy renovations (Milin and Bullier 2011; CECODHAS 2012). There is a possibility to fund energy investments through energy performance contracting, but this requires that 100% of the tenants give their agreement and sign a form in order for the housing provider to be able to recover the investment completely through rents (Milin and Bullier 2011). Moreover, occupant take-back is a concern, as residents are likely to improve comfort levels as a result of the renovation (see Riccardo and Pollak 2006)
- **Organizational problems:** The landlord-tenant dilemma is a critical barrier, since the building owners have difficulties in recovering their investments via rents. Public budgeting practices are also a major problem, according to one of our interviewees. An additional organizational barrier can be the difficulty of getting tenants to agree to renovations.
- **Lack of information and skills:** There are differences between social housing organizations in this respect, but according to our experts, technicians are generally not very familiar with energy efficiency and renewable energy solutions; hence, lack of attention and knowledge and skills are rated as critical. Lack of reliable advice is a lesser barrier since the national association of social housing providers is quite active in energy efficiency issues.
- **Transaction costs** are similar as for other housing owner groups: lack of skilled service providers and high information search costs are rated as critical. This does not so much relate to the search for solutions, considering that the buildings are quite homogeneous (Riccardo and Pollak 2006), but to the difficulties of organizing public tendering for the procurement of materials and services.

Energy cost savings and a general improvement of living conditions are likely to be major drivers for energy renovations. The social housing stock was mainly built from the 1950s to the 1970s. It is now ageing and facing problems of deterioration, due to the fact that the buildings were often constructed on low budgets and short time schedules (Riccardo and Pollak 2006). The need to avoid further deterioration is thus a major driver, as are the rising operating costs, particularly due to high energy consumption, as well as the need to make improvements in ventilation and moisture removal (Boeri et al. 2011).

According to one of our interviewees, the tenants' associations, which are very strong organizations, could serve as a major driver if they were to prioritize energy renovations on their agenda. A further measure to drive renovations could be if energy efficiency investments were somehow removed from the overall public

investment moratorium in Italy, considering that they also save money for the public sector in the long term.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for social housing owners:

- **Financial criteria** are very important. Because social housing providers own fairly large housing stocks, they are in principle likely to pay attention also to payback times and returns on investment, but the current situation focuses all attention to initial costs, according to our expert interview.
- **Ease of renovation:** If financial issues were not so critical, the availability of quality service and turnkey solutions, as well as quick installation might have some importance, especially for acceptance by tenants.
- **Lifetime and risk considerations:** Timing is quite important, though many necessary improvements seem to have already been delayed (Boeri et al. 2011). Ease of maintenance is a top priority, because of lacking skills and high turnover of residents and staff. The availability of widely used solutions have medium weight.
- **Other benefits:** Improved comfort can be important for acceptance by tenants. In contrast, improved value of property is not likely to be a very achievable goal, even though several social housing providers would like to sell the apartments they own. Nor is the social status of social housing estates likely to improve significantly through energy efficiency or renewable energy.
- **Environmental and societal motives and pressures:** Environmental considerations are not among the urgent priorities of Italian social housing providers, which are struggling with financial problems and to meet the housing needs in their regions (CECODHAS 2012). However, expected future regulation can be somewhat important (Riccardo and Pollak 2006).

10.2.5 Public buildings

Public buildings make up 8.8% of the total building area. The exact share of buildings owned by the state, the regions and local government are not known. However, as Italian public policy is highly decentralized, it is likely that most buildings are owned by regional and local government. Decisions are made by the respective building owners, but the decision-making is complex, as maintenance and refurbishment are usually managed by a different department (and constitute different budget items) than energy costs (Pindar and Papetti 2002).

There is legislation in Italy requiring public administration to implement energy saving solutions where these prove technically feasible and economic; especially air conditioning and building envelopes are mentioned (Law 10, 1991). However, Pindar and Papetti (2002) report that this legislation is not always respected in practice. Legislative Decree 115/08 includes new provisions, such as requiring the use of financial instruments (e.g EPCs) for energy saving in buildings, energy audits when buildings are to be refurbished, and the display of energy performance certificates. Recently, also, certification for energy managers has been introduced and an observatory has been set up to monitor progress toward energy efficiency in the public sector (NEEAP2 2011). On the other hand, some regions and cities have been very active in auditing, and planning and implementing energy investments in their building stock (GovernEE 2012).

According to one of our interviewees, money is currently the overriding barrier to energy investments. The internal pact of stability precludes any new public investments, including those that could help public authorities in reducing their current expenses. The main barriers to energy renovations in public buildings can thus be summarized as follows:

- **Genuine uncertainties regarding cost effectiveness:** As in other owner groups, heterogeneous outcomes and uncertainty concerning measurement and verification of savings are critical barriers. This is also because of the diversity of the building stock (including very old and historical buildings)

and due to public accounting practices, where investments and operating expenses are considered separately (Pindar and Pinelli 2002). Uncertainty about verification of savings can also be an obstacle to applying energy performance contracting (Milin and Bullier 2011).

- **Financial barriers:** These are presently all critical barriers for public authorities, as mentioned above. However, the long payback times for energy investments were a critical barrier also under better financial circumstances (Pindar and Pinelli 2002).
- **Organizational problems:** Public budgeting practices constitute a critical barrier. According to Pindar and Pinelli (2002), this applies to different extents in different parts of the public administration. They mention several related issues: the low priority of energy issues at top decision levels (e.g. municipal budget), the lack of an investment culture, and the related disincentive to optimizing expenditure over product and service lifetimes, which is caused by the division of investment and management budgets. Pindar and Pinelli (2002) also report that in a number of cases, investment and management budgets are also separated across different public authorities (e.g., when one ministry rents facilities from another) or different levels of authority within a municipality. While ESCO contracting could overcome some of these problems, it is hampered by difficulties in contracting and dividing costs and risks among the parties (Ministry of Economic Development 2012).
- **Lack of information and skills:** As owners of large building stocks, with professional energy managers employed, the different levels of government owning public buildings are likely to have less problems with information and skills than do e.g. private households.
- **Transaction costs:** Due to the better knowledge level, organization of public tendering and greater market power, problems in finding skilled service providers and in information search are less severe than for smaller customers. Nonetheless, all categories of transaction costs are still lesser barriers to energy investments in public buildings.

The main drivers for energy efficiency in the public sector are likely to be the need for public authorities to set a good example; including the measures already taken such as the appointment of energy managers and the data gained from energy audits and energy performance certificates (NEEAP2 2011). Cost savings can also be significant: ENEA (2009b) calculated that more than 420 million € could be saved annually in energy bills through cost-effective energy investments in schools and public office buildings. Moreover, these investments could trigger an increase in GDP of 0.6%. Another major driver hence is the employment potential. Other expected benefits include improvement of labour productivity, workplace quality and health and safety of building uses (ENEA 2009b).

The government has also allocated funds to local governments under the Interregional Operating Programme, Renewable Energy and Energy Savings (POI Energia) 2007-2013, with the aim to promote both renewable energy and energy savings together with economic development in developing regions (NEEAP2 2011). There has also been significant effort to organize funding for energy efficiency projects, e.g., through the certification of ESCOs and efforts to integrate them more in the Energy Savings Obligation Scheme, as well as the development of Green Bonds and a national revolving fund for energy efficiency investments (NEEAP2 2011).

Additionally, regional and local governments have made commitments that go beyond that of the national government. This is reflected, for example, in the large number (800) municipalities that have signed the Covenant of Mayors commitment and started drafting sustainable energy action plans (NEEAP2 2011). Several regions and cities have developed projects and plans, e.g., to refurbish historical public buildings to improve their energy efficiency and usefulness (GovernEE 2012).

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for public buildings:

- **Financial criteria** are naturally important when making investments using public funds. However, public buildings have a level of professional management, and public tenders give weight to more long-term financial indicators such as payback time and return on investment. Under normal

conditions, a wider range of criteria might be used, but the current situation demands a focus on initial costs.

- **Ease of renovation** has medium weight, including the quality of service, quick installation and turnkey solutions.
- **Lifetime and risk considerations** are usually relevant for public buildings, including timing, ease of maintenance and the availability of widely used solutions (see GovernEE 2012). However, they do not rise to the fore in the current financial situation.
- **Other benefits:** Improved comfort and productivity are increasingly discussed, but do not yet gain a significant role in energy investment decisions. Improved value of property is not relevant for public buildings. If social approval is considered to include political popularity, it can be considered to have a medium weight in decisions, according to our interview data.
- **Environmental and societal motives and pressures** are important for the public sector, including environmental considerations, expected future regulations and recommendations by experts. These, too, are currently overshadowed by the current financial crisis.

10.2.6 Office buildings

Commercial office buildings make up 1.4% of the total building area. The share of owner-occupied vs. rented office buildings is not known. Decisions concerning renovations are made by the owners: in the case of owner-occupied offices, the occupying companies, and in the case of rented offices, by professional property management companies. This leads to slightly different situations, which are highlighted in the following.

In general, our interviews suggest that real estate property investors have a very limited perspective. For example, their payback expectations can be as short as three years. This is supported by the assessment of the Ministry of Economic Development (2012), which suggests that a lack of focus on energy issues is the main barrier for the commercial service sector, followed by initial costs and expectations of short payback times. Lack of awareness and accessibility of support were mentioned as other lesser barriers.

The main barriers to energy renovations in office buildings can be summarized as follows.

- **Genuine uncertainties regarding cost-effectiveness:** Critical barriers include heterogeneous outcomes and uncertainty concerning measurement and verification of energy savings. These are important for businesses, which want to calculate the expected return on investment accurately.
- **Financial barriers:** Long payback times are a critical barrier. Lesser barriers include high initial costs, access to capital, unwillingness to incur debt and uncertainties about the impact of the investment on resale value. Companies want to maintain their assets for investments in their core business (Di Santo 2012).
- **Organizational problems:** Landlord-tenant dilemmas can be a barrier for rented offices, since tenants generally pay for their own energy costs.
- **Lack of information and skills:** Low awareness and knowledge and lack of reliable advice are all lesser barriers for office building owners, as is unsophisticated financial analysis. The share of energy costs is usually relatively small in the service sector, and hence not a main focus for management attention (Ministry of Economic Development 2012).
- **Transaction costs:** Office building owners are better positioned to contract skilled service providers and find information than e.g. households, so these are minor barriers. However, the costs of disruption and the risks of failure are critical barriers, because these can cause financial losses.

There are no significant regulatory or stakeholder drivers for energy renovations in office buildings. In recent years, sensitivity to corporate responsibility issues has grown in large companies, but the level of such pressures is still very low. At present, in the context of the economic crisis, private companies (especially the small and medium sized ones, representing 90% of the total) are struggling to survive and stay on the market. The energy efficiency of their office buildings is very low on their list of priorities.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for office building owners:

- **Financial criteria** are naturally important for businesses. The professional financial analysis used by businesses gives priority to financial indicators such as payback time and return on investment.
- **Ease of renovation:** The availability of quality services has medium weight, but quick installation has a relatively high weight as disruptions can be costly.
- **Lifetime and risk considerations:** Timing and ease of maintenance are quite important, as they have financial implications. Widely used solutions have medium weight.
- **Other benefits:** Improved comfort is a medium-level factor, as it can have an impact on employee productivity for owner-occupiers, and can increase rental values for professional property owners. Improved value of property is quite important, especially for professional office space providers. Social approval or status can have bearing on decisions by some, but not many, office owners.
- **Environmental and societal motives and pressures:** Companies are under pressure to exhibit good environmental citizenship: energy efficiency measures in business premises can be a cost-effective way to do this. However, in the current situation and the companies' struggle to survive, these are not expected to have a major role in decisions.

10.3 Discussion on barriers and drivers of energy renovations

Italy has traditionally had a fairly forceful energy efficiency policy, considering the low energy intensity of the economy. However, this has been hampered by various types of market failures, including the lack of capital, as well as organizational and informational barriers (Ministry of Economic Development 2012). These are today intensified by the current financial crisis.

Table 10.2 presents an overview of the main barriers to energy investments for various building owner groups, on the basis of our review and expert interviews. Genuine uncertainties play a certain role for several owner groups, especially concerning verification of energy savings. Financial barriers are also widespread concerns, especially initial costs, long payback times and access to capital. The current financial situation also intensifies the overall unwillingness to incur debt. Collective decision problems, however, are the most severe barriers for multifamily housing, which constitutes a relatively large of the total housing stock. Lack of customer knowledge and lack of reliable advice are also widespread barriers in the residential sector, as is the difficulty in finding skilled service providers. According to our interview data, the public sector is struggling with a different and even more severe problem, i.e., the inability to make any new investments in the face of the internal stability pact.

Table 10.2. Most widespread and critical barriers among different building owner groups. Barriers rated critical are indicated in red and less critical ones in orange.

	Single-family homes	Owner-occupied apartments	Privately owned rental apartments	Social rental housing	Public buildings	Office buildings
Genuine uncertainties regarding cost effectiveness						
Conflicting information, mistrust of information						
Heterogeneous outcomes						
Uncertainty concerning measurement & verification of savings						
Financial barriers						
High initial costs						
Long payback time						
Access to/cost of capital						
Unwillingness to incur debt						
Occupant take-back						
Low/uncertain resale value of property						
Organizational problems						
Landlord-tenant dilemma						
Collective decision problems						
Short timeframe of decisions						
Public budgeting practices						
Lack of information and skills						
Lack of customer attention and interest						
Lack of customer knowledge						
Lack of reliable advice						
Unsophisticated financial analysis						
Transaction costs						
Lack of skilled service providers						
High information search costs						
Switching costs, concerns over disruption						
Risks of failures in renovation						

Source: interviews and literature as presented above.

Several parties influence, or can influence the situation, and support the process of energy renovations by building owners:

- **Regional and local governments** have been particularly active in Italy. Some have implemented their own ambitious energy standards, energy performance certification schemes, as well as ambitious promotion and incentive schemes for energy investments in buildings (Ruggieri et al. 2011; Zobot et al. 2011).
- **The national government and the national energy agency ENEA:** The government has a central role in setting the overall targets and framework (e.g. EPBD2 implementation), and ENEA has a central role in planning and providing advice for building owners, as well as in stimulating the development of new solutions.
- **NGOs** are playing a growingly active role in promoting energy efficiency, as reflected e.g. in a WWF contracted study on barriers to energy efficiency in condominiums (Ruggieri et al 2007).
- **Companies offering solutions:** Renovation is a major industry in Italy, and contractors are active in promoting solutions. However, Ruggieri et al. (2007) suggest that qualifications for professionals should be strengthened, that also building administrators and heating system managers could take a more active role in energy management, the role of energy performance certificates should be strengthened by including advice on measures to be taken, and that ESCOs could be supported by organizing regional certification.
- **Financial institutions:** There are successful local examples where bank financing has been mobilized by public sector guarantees and incentives (Ruggieri et al. 2011). Ruggieri et al. (2007) suggest that such public-private partnerships should be further developed, dedicated funds be established, and also insurance products be developed to support ESCO expansion.
- **Energy utilities** play a central role via the white certificates scheme. The government expects to further strengthen this scheme in the new national energy strategy (Ministry of Economic Development 2012).

There are several drivers for energy efficiency improvements in existing buildings. Economic benefits are widely recognized, as energy is relatively expensive in Italy. However, for residential customers, issues of comfort are the most important driver, and the perceived technical need to renovate is important for all types of building owners. Table 10.3 provides an overview of the most important decision criteria for each owner group, as identified in our study. Economic criteria are among the most important for all groups, and the emphasis on initial costs cuts across all owner groups. Timing is also a widespread concern, as is improved comfort for all kinds of residential building owners. For the public sector, there are many criteria that were deemed as having medium value (e.g. environmental and societal concerns), however, they cannot compete with the cost criterion under the current financial austerity regime. They could probably gain importance if financing can be organized via third parties.

Table 10.3. Most important decision criteria for the major owner groups.

	Single-family homes	Owner-occupied apartments	Private rental apartments	Social housing	Public buildings	Office buildings
Financial						
Initial cost						
Payback time				?		
Return on investment				?		
Ease of renovation						
Quality service available					?	
Quick installation					?	
Turnkey solutions available					?	
Lifetime and risk considerations						
Timing vis-a-vis previous renovations						
Ease of maintenance					?	
Widely used solution						
Other benefits						
Improved comfort						
Improved value of property						
Social approval/status					?	
Environmental considerations						
Expected future regulation					?	
Recommendation by experts					?	

Source: interviews and literature as presented above.

11 ROMANIA

11.1 General overview

The building stock in Romania is newer than in most countries of Central Europe: the largest share of current buildings was built in the post-war period (1945-1970) (Housing Statistics 2010). However, there are significant problems in the condition of buildings due to neglect of repairs, in particular, in urban high-rise apartment buildings and in part of the rural single-family homes (UN ECE 2001; Trainrebuild 2012). A noteworthy factor concerning residential housing is the large share of owner-occupancy: more than 90% of dwellings are owner-occupied (Housing Statistics 2010); another is the relatively large share of rural population; about half of all Romanians live in rural areas.

The Ministry for Development, Public Works and Housing is in charge of energy efficiency policy in buildings (NEEAP 2007). Romania has made progress in the development and implementation of policies and laws to address the energy efficiency of buildings as part of European policy implementation. Minimum requirements for the energy performance of building components used in new buildings and buildings subject to major renovation have been set (BPIE 2012a). Energy performance certification of buildings when they are sold or rented is also required by legislation (BPIE 2012a), though Prada (2011) and ROBGC (2009) report on some enforcement problems in this area. However, since 2011, the widespread use of energy performance certificates when buildings are rented or sold has significantly raised public awareness of energy in buildings (BPIE 2012a).

Several support programmes target the thermal renovation of existing buildings, as this is not only an energy, but also a housing quality issue. There are programmes dedicated to public buildings, to the rehabilitation of residential high-rise panel buildings built by 1990, a loan scheme for residential buildings built by 2000, and financing schemes for introducing renewable energy in buildings (BPIE 2012a) (for more details see following section). There are also several support programmes for the renovation of public buildings, and also international funds available for co-funding the renovation of commercial buildings.

In general, the country report for MURE (Rugina 2009) reports a significant decrease in energy consumption in the residential sector. This is estimated as being due to price increases in energy, an overall increase in energy efficiency, as well as the rapid rate of new building until quite recently.

However, there are several challenges remaining in the improvement of energy efficiency in the existing building stock. These relate to the severe financial situation and the high interest rates in the country. While awareness among residential building owners has grown, this is from a low level and a situation where energy prices were heavily subsidized. Due to the limited experience with renovation and a general shortage of skilled labour, building owners have difficulties in finding good-quality services. This problem is currently being addressed in an Intelligent Energy Europe programme under Build-Up Skills Romania, which aims to develop a national qualification roadmap for the construction industry.

Table 11.1 presents the major building owners and decision makers in Romania by building type. Most of the housing stock in Romania is owner-occupied. The share of rental dwellings is very small. The major owners, their decision structures, and the main barriers and drivers for energy renovations are discussed in more detail in the next section.

Table 11.1. Major owners and decision makers for residential, public and office buildings

Building and owner type	Share of total building area, %	Decision makers and types of owners
Single-family (attached and detached)		
Owner-occupied	57,0	Owners individually: private households
Rented	1,0	Owners individually (mainly private households)
Apartment buildings		
Owner-occupied	29,6	Owners collectively
Private rental	0,5	Owners (mainly private households), companies
Social rental	0,7	Owners: Social housing organizations
Public buildings		
State	0,24	Owners: ministries and state agencies
Local government	0,39	Owners: local governments
Educational buildings	3,0	Largely owned by state/municipalities (some can also have private owners)
Hospitals	1,0	Largely owned by state/municipalities (some can also have private owners)
Commercial office buildings		
Owner-occupied or rental	0,9	Companies using buildings, professional property management companies, portfolio investors
Other	5,67	
Total	100	

Source: BPIE (2012)

11.3 Barriers and drivers of energy renovations among major building owner groups

11.3.1 Single-family houses

Owner-occupied detached and attached single-family houses are here discussed as one group, and rental single-family houses are not discussed separately²¹. Detached single-family houses make up more than half of the total floor area in the country, and are the most dominant form of residential house in Romania. Most of these are owner-occupied. Most are located in rural areas, where almost half of the population lives. Several buildings are in poor condition, lacking basic amenities such modern water and sewage facilities (Mihaela and Milin 2006; de Vries 2009). On the other hand, significant new development of single-family housing has been seen in suburban areas and in villages near cities: these are usually owned by relatively wealthy people (Neamțu 2005).

In the case of single-family houses, the owners can mainly be influenced public authorities, through support schemes and incentives. One of the available support systems is the Green House programme, which offers grants of about 1300-1800 € to encourage homeowners to solar panels, heat pumps or boilers using wood-based fuel, and has been reported to be very popular (URBACT 2010). Single-family home owners are

²¹ Rented detached houses constitute a small share of all detached houses. They are usually owned by private persons, and the decision structures are quite similar to those of owner-occupied detached single-family homes. In the following, they are included in the general category of single-family houses. Owner-occupied or rented attached single-family houses constitute about 4% of the total floorspace. They are owned by private persons, and the decision structures are fairly similar to those of owner-occupied detached single-family homes. In the following, they are included in this same category.

also entitled to a government-guaranteed bank loan for energy renovations, provided under Government Emergency Order No 69/2010 (BPIE 2012a).

According to our interviewees, however, single-family homes have been targeted much less by public renovation policy instruments than the multifamily buildings, which are located in city centers. Due to the rapid socio-economic and urban development, old single-family houses are quite often demolished rather than refurbished. This is because the value of the land is greater than that of the building (in or near urban areas) and because of the poor condition of the buildings, due to the earthquakes of the 1970s and the outdated facilities.

According to our interviewees, there is a great pressure to build and refurbish single-family homes, but these are usually done at the lowest possible cost without much attention to planning. There is a great aversion to debt, and refurbishments are generally done at least initial cost, with the help of friends or contracting of individual workmen.

The main barriers to energy renovations in single-family homes are summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** include one critical barrier, heterogeneous outcomes. Most detached single-family houses are old, and hence different from one another. Projected savings might not always translate into real savings. Moreover, conflicting information and mistrust of information is a lesser, related barrier.
- **Financial barriers** are the most critical group of barriers. Many of the detached houses are located in rural areas, where incomes are among the lowest in Europe (Mihaela and Milin 2006; Eurostat 2011). Hence, initial costs are insurmountable barriers for many homeowners, as are long payback times and difficult access to capital, but mainly due to the low purchasing power in country. In general, in the context of the financial crisis, consumers tend to focus on short-term benefits (BPIE 2012b). Romanians are not eager to incur debt (BPIE 2012b), which is also a critical barrier to renovations. Low or uncertain resale values of detached houses constitute a lesser barrier. Moreover, energy prices are relatively low and there are still subsidies on energy consumption in the residential sector, which further detracts from the financial attractiveness of energy renovations.
- **Organizational problems** include fewer barriers, as detached home owners make decisions on their own or among the family. However, the short time frame of decisions compounded by overall uncertainty (BPIE 2012b), constitutes a lesser barrier for some home owners.
- **Lack of information and skills** involves several important barriers. The lack of reliable advice is rated a critical barrier, as is the homeowners' lack of sophisticated financial analysis. Our interviewees stressed that little attention is devoted to planning, and architects are mainly employed if they are necessary for the building permit. Lack of attention and interest and lack of customer knowledge are lesser, but still noteworthy barriers (BPIE 2012b).
- **Transaction costs** involve barriers, but in comparison to financial and knowledge related barriers, they are not in general the most important ones. The lack of skilled service providers is a serious problem, as Romania experiences a deficit of construction workers and has seen an exodus of construction specialists (Luca 2009). High information search costs and concerns over disruption and switching costs are lesser barriers. Risk of failure may be a concern (especially for fully contracted work), but not usually a major concern when making the decision to renovate.

In spite of these barriers, single-family homes are sometimes renovated. The main driver for the renovation of single-family homes relates to improvements in thermal comfort and to improving the overall appearance and functionality of the building (Telece 2012): this may include energy-related goals when they are recognized as part of the broader goals. The possibility to save money is also a major driver (Engewald and Grätz 2011). Our interviewees also pointed out that change of ownership can be a natural time to make a renovation.

According to our interviewees, the most common types of renovation are to add insulation or to replace heating systems, in which case the new system can be very efficient. Rugina (2009) has stressed this point:

there has been a significant shift from firewood to natural gas due to active promotion by the natural gas providers.

In terms of government programmes, more attention has been directed to multifamily buildings (especially panel buildings) than single-family homes. However, the government Green Homes programme offers subsidies new renewable heating systems in buildings (URBACT 2010) and single-family home owners are entitled to a government-guaranteed bank loan for energy renovations (BPIE 2012a). Moreover, several banks offer loan products for home renovation (Banică & Parlog 2007). However, our interviewees pointed out that Romanians are averse to debt and do not take out large enough loans for comprehensive renovations.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for single-family homeowners:

- **Financial criteria** dominate, as average incomes are low in general, and particularly low among the rural population owning a large share of this building category. Thus, initial cost and payback time are likely to be the most important criteria. The amount of energy saved is important in the context of delivering cost savings on future energy bills – it is here reflected in the payback criterion, although our interviewees suggested that people do not usually calculate in such detail.
- **Ease of renovation** criteria can have a role in decisions, in particular, the availability of quality service and the possibility for quick installation. The availability of turnkey solutions may play a role, in particular for the wealthier home owners. However, our interviewees reported that most single-family homes plan and make renovations themselves or with the help of individual hired contractors.
- **Lifetime and risk considerations:** Timing vis-à-vis previous renovations is not deemed particularly important, considering the long-term neglect of renovation for years. Ease of maintenance is of similarly medium importance, but can have a role e.g. in the case of heating systems. Widely used solutions are relatively popular, as few owners have a great deal of expertise.
- **Other benefits:** Improved comfort is naturally important and a major driver for renovations. However, improved value of property influences decisions mainly if the property is renovated before selling it. According to our interviewees, insulation can be important for selling a property, but owners often install only minimal insulation. Social approval or status are not particularly important as decision criteria for energy renovations according to our Romanian experts.
- **Environmental and societal criteria** are not particularly important, as other issues in daily life are much more urgent. Environmental considerations have the lowest weight, whereas expected future regulations and recommendations by experts can have a small role in decision making.

11.3.2 Owner-occupied apartment buildings

Owner-occupied multifamily houses are the other major form of residence, which is predominant in urban areas. Almost all apartments are owner-occupied. They are governed by a homeowners' association, a nonprofit company for improving and managing the building (IIBW 2008). The homeowners' association takes decisions at a general meeting, which among other things, approves budgets. It elects an executive committee, which e.g. plans for revenues and cost budgets and prepares general meetings, regulates the maintenance and repairs of common parts, as well as supervises construction activities²². The owners are obligated to approve an annual reparation fund for common property (IIBW 2008).

The decision concerning intervention on the building's common parts (including on the building envelope) may be taken with two thirds (67%) of the owners. However, if the owners disagreeing to the intervention

²² The executive committee is ultimately responsible for ensuring the physical integrity of the building operated by the owners association. These responsibilities include facilitating the adoption of a management plan, ensuring adherence to the plan, ensuring that the building and adjacent areas are well maintained, and contracting with service providers.

decide to not support the share of costs, then the other owners have to advance the payments and only later on, in court, they can claim to be reimbursed (and it remains to be decided if they are right and how they will be paid back). There are no specific measures in place for overcoming this barrier, which may be enough to stop any investments. Therefore, when the owners' association intends to undergo a high-cost intervention on the building, the decision has to reach complete approval of the owners in order to be implemented in practice.

Day-to-day management of housing associations can be contracted to private persons, associations, public agencies or, increasingly, specialised companies, which require a licence or authorization for this task (IIBW 2008)²³. The house managers can also have a role in catalyzing the owners' associations' decision to apply for a renovation grant.

Renovation decisions in owner-occupied apartment buildings are mainly influenced by public authorities through support schemes and incentives. These can be quite generous. The National Multiannual Program of Thermal Building Rehabilitation funds 50% of refurbishments reducing the annual consumption for heating below 100 kWh/m² from the state budget, 30% from local authorities and the remaining 20% from funds of owner associations. In several cities, the local authorities cover also the beneficiaries' share via grants or by taking out a loan for this purpose (Rezessy and Bertoldi 2010). There are also interest-subsidized loans and savings programmes available, and in fact, the 20% own funding for the thermal rehabilitation programme can be covered by a loan from a subsidized house saving account (REC 2012).

The main barrier to energy renovations in owner-occupied apartments is organizational (see below). In general, the role of various barriers in the case of this owner group can be summarized as follows:

- **Genuine uncertainties regarding cost effectiveness:** Heterogeneous outcomes are considered a critical barrier. This is largely due to the quality of renovation services, which is increasingly discussed according to our interviewees (see also Dabija 2010). A lesser, but still relevant, barrier is created by the circulation of conflicting information and residents' mistrust of information.
- **Financial barriers** are a serious obstacle to energy renovations, due to low income levels and the large share of pensioners, on the one hand, and relatively low and partly subsidized energy prices. While there is a fairly generous grant scheme available, Musatescu and Comanescu (2009) report that residents are often unwilling to pay even 20% of the renovations themselves. High initial costs are thus a problem, as are relatively long estimated payback times. Access to capital and the cost of capital are also severe barriers, as the taking out a loan for a homeowners' association is fairly complicated (IIBW 2008)²⁴. Moreover, loan periods are too short to amortize the investment with reasonable repayments (BPIE 2012b). A related, but lesser, barrier is the low or uncertain resale value of property.
- **Organizational problems:** Our interviewees confirmed that collective decision problems are the most critical barrier (Teleche 2012). The required majority for decisions on renovations is high: in practice all residents usually need to agree, although the legal requirement is two-thirds, because mortgages need to be signed by all residents (IIBW 2008). A lesser barrier relates to the relatively short time-frame of decisions, which is linked to the overall uncertainty concerning the future (Danish Ecological Council 2006; BPIE 2012b).
- **Lack of information and skills:** Since rising energy bills are a concern, lack of customer attention and interest and lack of customer knowledge are not critical barriers, although they still exist. In particular, our interviewees stressed the limited capacity of house managers to manage complex renovations. However, critical barriers in this category include lack of reliable advice and lack of sophisticated financial analysis.

²³ The main tasks of the house manager are to administer the goods and funds; prepare the contracts with all suppliers of services; inform all residents of the regulations governing their cohabitation; and represent the owners' interests in contracts signed with the public authorities and fulfill any other legally contracted responsibilities (IIBW 2008).

²⁴ Our interviewees also confirmed that the taking out of a loan can be very complicated and indeed require that all or almost all owners sign their own mortgages.

- **Transaction costs include one critical barrier.** The lack of skilled service providers is a severe problem in Romania, which has a shortage of workforce in the construction sector and has lost many skilled professionals due to emigration (Luca 2009). This was also stressed by our interviewees, even though there is now a major effort underway to ameliorate this problem. The quality of workmanship is often low (Dabija 2010). High information search costs, concerns over disruption and risks of failures in renovation constitute lesser barriers.²⁵

Our interviewees confirmed that the poor condition of buildings and the need for increased thermal comfort are major drivers for energy renovations. However, according to Dabija (2010), these have been addressed in the past years by residents' own attempts to improve thermal comfort, e.g. insulate windows. Another potentially driving force is the requirement for the executive board of the residents' association to assess renovation needs, and the mandatory requirement for the residents' association to maintain a repair fund (IIBW (2008)); however, until now, our interviewees commented that repair funds are far from sufficient for significant thermal renovation works.

The government offers a comparatively generous grant scheme for the renovation of multi-family buildings. According to the Thermal Rehabilitation Act, the government currently covers 50% of the renovation, whereas local governments cover 30% and 20% should be covered by the residents' association (URBACT 2010). About 33 MEUR were distributed from the multi-annual programme for this purpose to more than 1300 buildings in 2011 (Ministry of Regional Development and Tourism 2012).²⁶

According to our interviewees, good examples can be an important driving force for the renovation on apartment buildings. They reported that a significant effort to renovate panel apartment blocks in Bucharest is now ongoing: for example, the entire sector 1 is being renovated, primarily funded by the municipality. In general, the renovation activity, according to our interviewees, has "exploded" since 1989, and any residents have replaced their windows in the past decades.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria on owner-occupied apartment buildings:

- **Financial criteria** dominate, as average incomes are low in general. Our interviewees also reported that the most active participants in residents' meetings are pensioners, who object to any major investments. Thus, the most important criteria are initial cost and payback time. This is further confirmed by the fact that many apartment owners' associations have been unwilling to cover even their own small part of the renovation costs (Musatescu and Comanescu 2009; Luca 2010). More sophisticated measures such as return on investment are less commonly considered by ordinary residents.
- **Ease of renovation** can play a role in renovation decisions by homeowners' associations. Yet, expectations are not very high yet; thus the availability of good quality services and the speed of installation are not deemed so relevant by our interviewees. The availability of full-service packages and turnkey solutions can, however, be quite important. According to our interviewees, house managers do not have the capacity to manage major renovations; most of the renovations conducted until now have been done with technical support by the municipality.
- **Lifetime and risk considerations:** Timing vis-à-vis previous renovations is not so relevant, as comprehensive renovations have been neglected for so many years and several residents have made their own small repairs (Dabija 2010)²⁷. Ease of maintenance has a medium role. However,

²⁵ Risks of failure in renovations are also real, but not actively considered by residents since other problems are more severe. Our interviewees stressed that there is in general little follow-up or monitoring of the performance of renovations. Hence, this problem can arise once there is more experience of major renovations, which are a new phenomenon in Romania.

²⁶ One of our interviewees reported that there is a recent law to divert more European funding, following which renovations could be funded with 60% European funding and 30-40% by the local municipality, but with a requirement of 10% funding by the owners.

²⁷ One of our interviewees commented that in Bucharest at least, the renovations take these into account. E.g. where residents have replaced their windows, these newer windows are kept even when the façade is renovated and faulty windows are replaced. This might not be such a good solution technically, but it might facilitate the residents' decisions.

the availability of widely used solutions and the examples from other successful renovations can be important motivators, which were also stressed by our interviewees.

- **Other benefits:** Improved comfort is a major driver and motivation for renovations. However, improved value of the property and social approval are lesser concerns.
- **Environmental and societal motives and pressures** are negligible as decision criteria, which was confirmed by our interviewees (however, they pointed out that these may become more important in the long term). Environment is not a priority for residents, and expected future regulations and recommendations by experts have a small role in decisions.

11.3.3 Rental apartment buildings: municipally owned social housing

Rental housing is rare in Romania, as almost all state-owned housing was handed over to tenants. Private rental apartments are usually individual apartments in owner-occupied buildings. Hence, they are here discussed as part of the owner-occupied sector (section 11.2.2).

Social rental housing is completely owned by the local authorities, and only makes up a tiny share of the total housing stock. In Romania, the term social housing (or ‘social houses’) is officially defined as ‘public dwellings with subsidized lease, allocated to individuals or families whose financial position would not otherwise allow them access to tenements leased on the market’ (CECODHAS 2012). Rents are controlled. Rent levels are determined by Government Emergency Ordinance 40/1999 which sets tariffs that are updated each year for inflation. The maximum rent for public or private housing units must not exceed 25% of a family’s monthly gross income, or of the national average, whichever is the lower (IIBW 2008).

It is important to bear in mind that the social housing sector in Romania is very small and almost 100% public. Usually the residents are poor and less educated and thus do not have the means to contribute to a renovation programme. Hence this is an activity that is completely funded by public authorities.

The main barriers to energy renovations in social rental housing can be summarized as follows:

- **Genuine uncertainties** include on critical barrier: Heterogeneous outcomes. The outcomes in terms of savings can be largely offset by an increase in consumption due to the improper maintenance and use of the improved buildings. The occupancy effect may be quite large in this sector. A lesser barrier in this category pertains to conflicting information and mistrust of information regarding the cost-effectiveness of renovations.
- **Financial barriers** in general are critical. These relate to the limited local resources and low (regulated) rent levels, which do not even cover maintenance costs (Energie-Cités 2009). Following this, initial costs and access to capital are critical barriers for the building owners, the municipalities. According to our interviewees, municipalities have also upper debt levels, which can be a major barrier for large investment programmes. Long payback times are deemed to be a lesser barrier.
- **Organizational problems** relate to public budgeting practices. If municipalities save on energy costs, they may lose some of their state allocations (see below for more details in the section on municipal public buildings).
- **Lack of information and skills:** Lack of interest and attention is likely when social housing is only a small part of the overall municipal operations. Similarly, lack of customer knowledge and the lack of reliable advice contribute to the problems. While information to residents is necessary for starting the renovation activities, it is also vital to educate them on how to maintain and respect the improved building.
- **Transaction costs** include lesser barriers. Lack of skilled service providers and high information search costs are a problem, but not one that features in municipalities’ decision-making as a major barrier. However, concerns over disruption and risks of failure in renovation are something of a concern.

- **An additional barrier** not considered in the original list is the lack of public policies for social housing, which is a neglected area in Romanian housing policy (Tsenkova 2005).

The technical need for renovation and social and regional concerns are likely to be the most important drivers for municipalities to conduct renovations in social housing. There is a special funding programme for renovating housing in disfavoured areas, where the state covers 100% of the costs for local authorities (Ministry of Regional Development and Tourism 2012). It is also a political interest to reduce the energy bills of people in the context of high increase of energy prices and of inefficient district heating with high associated costs. Our interviewees suggested that political concerns can indeed be the major driver for renovations in municipally owned social housing.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria for social housing owners:

- **Financial criteria:** Due to public budgeting practices, initial costs and payback times are the most important criteria whereas return on investment and expected energy savings have less importance.
- **Ease of renovation** has a medium role. The availability of quality service, quick installation and turnkey solutions can to some extent facilitate the decision process and the communication with residents.
- **Lifetime and risk considerations:** Timing vis-à-vis previous renovations does not make a big difference, as repairs in general have been neglected for so long. However, ease of maintenance has a larger role in the social housing sector, as maintenance staff and residents are not particularly competent or reliable. As in other types of residential housing, the availability of widely used solutions creates confidence and reduces risks.
- **Other benefits:** Improved comfort can alleviate resistance by residents, however. Improved value of property is not relevant in this case. However, our interviewees stressed that social approval (i.e., political support) can play a role in municipal decision making and can, in fact, be a major driver for renovating these kinds of buildings.
- **Environmental and societal motives and pressures** have very minor roles. While some municipalities are aware of climate and energy issues (Rata 2012), this is not very visible in social housing renovation. Expected future regulation and recommendations by experts can have a slightly greater role in decision making.

11.3.5 State-owned public buildings

Decisions concerning renovations are made by state authorities, which have several programmes for the renovation of their building stock. It is estimated that there is significant potential for energy savings in buildings and the government has tried to promote ESCO projects in public buildings (Rotaru 2009).

While the leading role of the public sector is recognized in Romania, budgets for the renovation of public buildings have been chronically constrained. Hence, European funds have an important role in supporting and stimulating investments.

The main barriers to energy renovations in social rental housing can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness:** In particular, conflicting information concerning the cost-effectiveness of solutions is deemed critical, as are heterogeneous outcomes, as buildings are quite diverse.
- **Financial barriers** also include several critical barriers, including initial cost, long payback times, access to capital and the cost of capital as well as unwillingness to incur debt are understandable considering the current finances of the Romanian state.
- **Organizational problems** in general are critical. In particular, collective decision at the level of state administration are problematic, as many ministries are involved in the process. Similarly, public budgeting practices constitute a critical barrier. Energy savings are not rewarded to

administrative units. There are budgetary constrictions due to the economic crisis, and energy efficiency is currently still largely seen rather as an expenditure rather than as an investment which is paid back in time.

- **Lack of information and skills** include several critical barriers. Politicians and government officials have several other priorities: hence, lack of attention and interest in energy renovations is a major barrier. Similarly, lack of reliable advice and lack of sophisticated financial analysis are critical barriers. There is a need to improve good governance practice and to produce more impact assessment on buildings to support the policies and develop a long term strategy. Our interviewees agreed that this is the situation today: however, some commented that the EPBD and cost-optimality calculations can change the situation in the near future.
- **Transaction costs** include one critical barrier, the lack of skilled service providers. As stated above, many qualified experts in the field have moved to work abroad (Luca 2009). However, there is currently an IEE Build-Up skills project in Romania called ROBUST, which aims to produce strategies and roadmaps for improving the skills in construction. The project is implemented by several key stakeholders and endorsed by the related ministry. A lesser, but still relevant barrier are the switching costs and costs of disruption: this is a problem as the owners might even have to move the employees into other buildings during complex renovations.

The poor condition of buildings is likely to most dominant driver for energy renovations in state-owned buildings. For example, school buildings are old and in poor condition and refurbishment and modernisation are required (Government of Romania 2007).The Romanian NEEAP2 also mentions the worn-down condition of public buildings and the poor working conditions.

Moreover, the Energy Efficiency Directive will in the future require that 3% of buildings owned by central governments are renovated to cost-optimal levels. This is likely to create a relevant driver for state-owned public buildings to conduct energy renovations.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria in state-owned buildings:

- **Financial criteria** are dominant, due to the financial crisis and the poor state of public finances. However, because state-owned properties are professionally managed, return on investment has an equal weight to initial costs and payback times, and is likely to gain in importance in the future, according to our interviewees. Expected energy savings are a relevant criterion, also with the view to gaining EU structural funds for improvements in both energy efficiency and working conditions and overall utility of the buildings.
- **Ease of renovation:** The availability of good quality services and turnkey solutions can be relevant, but not among the most important criteria, according to our experts. However, quick installation is more important for the state than for many others, as e.g. hospital and school relocation can be expensive and difficult.
- **Lifetime and risk considerations:** Timing can play an important role according to our interviewees, as public buildings are renovated according to an investment plan.
- **Other benefits:** Improved comfort may be relevant for building users in e.g. schools and hospitals, and hence also for the administrations that represent them. However, improved value of the property is not relevant for these buildings, which are not for sale. In contrast, our interviewees stressed the importance of social approval: improvements in public buildings can be a visible way for politicians and administrations to win political support.
- **Environmental and societal motives and pressures** are not a priority for the Romanian state, which is struggling with other more urgent problems. However, the availability of EU structural funds, and the desire to absorb a fairer share of them, can give environmental criteria and European policy developments more weight than before, and plans are underway to develop a finance scheme for public building renovations with EU structural funds. Recommendations by experts are rated as playing a medium role in decisions about energy renovations.

11.3.6 Municipal public buildings

Municipalities own part of the public building stock. This includes the social housing buildings discussed above, and additionally e.g. city halls, offices, hospitals and schools.

There have been major programmes underway to support the renovation of municipal public buildings. For example, the National Program for Increasing Energy Efficiency and Renewable Energy Utilization in Public Sector for the period 2009-2010 offered grants for 30% of energy efficiency investment e.g. public building rehabilitation projects initiated by the municipalities. Municipalities with more than 20 000 inhabitants are required by law to appoint an energy manager to monitor and improve energy use and develop short, medium and long term energy efficiency programmes (TIME 2010).

However, like the state, also municipalities in Romania are struggling with several pressing problems. Hence, there are also several barriers remaining for energy renovations, which can be summarized as follows:

- **Financial barriers:** High initial costs, long payback times, access to and the cost of capital, as well as an unwillingness to incur debt are all deemed critical. As EBRD (2009) reports: “In many local authorities, energy saving measures are being addressed gradually through on-going maintenance and capital refurbishment programmes. However, these can take many years to complete as only a few buildings at a time can be funded from annual budget resources. In addition, capital funds are usually limited, so higher-cost measures such as boiler refurbishment or replacement are often postponed in favour of continued maintenance of old and inefficient facilities, even though in the long run this practice is much more expensive.” Our interviewees also stressed the importance of debt ceilings for municipalities, which further contribute to a slow pace of renovations.
- **Organizational problems** include several critical barriers. Collective decision problems are a major barrier: While municipalities have a small basic budget, they usually need co-funding from the state for major energy renovations. Funding from national programmes is decided by the state, and EU structural funds also usually require co-funding from the state. Public budgeting practices constitute another critical barrier. Energy savings are not rewarded in budgeting practices. For local authorities, the investment in renovation and the achievement of energy and cost savings may lead to potential cuts of future budgets allocated by central administration. The financial crisis has also led to budget cuts. Hence, energy efficiency is seen rather as an expenditure today and not as an investment which is paid back in time.
- **Lack of knowledge and skills:** EBRD (2009) reports that local authorities usually do not have the dedicated resources to prepare and implement a comprehensive energy efficiency programme, so many opportunities are often overlooked. Hence, in this category, lack of attention and interest (considering several competing priorities), lack of reliable advice and unsophisticated financial analysis are rated as critical.
- **Transaction costs** include one critical barrier: lack of skilled service providers, which applies to municipalities as well as to other building owners, as discussed above.

Cost savings are the major driver for municipalities. EBRD (2009) argues that there is a huge (30-40%) cost-effective potential in municipal buildings, and that investments in energy efficiency can theoretically be financed entirely on the basis of the saved energy, and capital costs can be recovered in just a few years. According to EBRD (2009), government strategies for financing energy efficiency include a plan to introduce legislation to encourage the development of Energy Service Companies (ESCOs) and the encouragement of financing of energy efficiency projects through access to FREE – the Romanian Fund for Energy Efficiency.

The Energy efficiency program for 2009 – 2010 for the public sector has included financial support, for some public buildings, of up to 50% for rehabilitation of a building’s indoor thermal and electric installations, improvement of the insulation of the building envelope, use of renewable energy and energy audits. Minimum energy efficiency requirements are also defined for public buildings when they are renovated; however, they are subject to willingness and ability-to-pay considerations (EBRD 2009). Energy

performance contracting (EPC) has been facilitated through regulation, but has nonetheless not become a common practice.

Some municipalities have recognized the opportunities and responsibilities related to climate change mitigation and adaptation. For example, 55 municipalities have signed the European Covenant of Mayors and 31 municipalities are members of Energy Cities Romania. However, at present, few municipalities have experience in developing sustainable energy policies and strategies (Rata 2012). There has been training for municipal energy managers and several local associations for energy have been established (NEEAP2 2011).

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria in municipal buildings:

- **Financial criteria** are dominant, due to the financial crisis and the poor state of public finances. However, because municipally owned properties are professionally managed, return on investment has an equal weight to initial costs and payback times.
- **Ease of renovation:** The availability of good quality services and turnkey solutions are deemed to play a medium role in decisions. However, quick installation is more important for municipalities than for many others, as relocation of activities may be very difficult. Our interviewees also stressed this point and the fact that building users can even block renovations that threaten to interrupt operations.
- **Lifetime and risk considerations:** In general, lifetime issues like ease of maintenance are deemed to play a medium role at best, due to the short time-frame of political decision making. However, our interviewees stressed the role of timing since public sector renovations are generally part of a larger investment plan.
- **Other benefits** are not so important for municipalities. However, improved comfort may be relevant for building users. Improved value of the property is not relevant for these buildings, which are not for sale. However, our interviewees stressed that political considerations can be very important: hence, social approval by the electorate is considered a major decision criterion.
- **Environmental pressures** are not a priority for Romanian municipalities in general, as they have several other more urgent problems, such as providing better service in schools and hospitals, improving comfort in public buildings and enhancing productivity. Expected future regulations are not seen as presenting major pressures for building renovation. Recommendations by experts play a medium role, however.

11.3.7 Offices

Commercial office buildings amount to about 1% of the total floors area. Unfortunately, the share of owner-occupied vs. rental office buildings is not known. It seems that commercial office property developers and office space providers are not as active in Romania as in other countries (Bates 2012); hence, a relatively large share of the offices is assumed to be owner-occupied. However, the new office buildings are rented by developers and over the last years this was the building sector with the highest construction rate (BPIE 2012a).

Energy efficiency and 'green building' initiatives are visible in Romania, but have focused more on newly built offices than on the renovation of existing ones. Borncamp (2010) reports that there is growing interest in green building certification among professional property developers and Purice (2012) reports on some major new developments by multinational companies (MNCs) that have green certification; however, this is from an initially very low level and the professionally managed or MNC-owned office buildings make up only a small part of the total building stock. Our interviewees reported that new office buildings are likely to consider e.g. the energy ratings of the energy performance certificate, but this is not necessarily the case in refurbishments: office owners usually add insulation and install a new heating system when renovations are made.

According to survey of the office building market by BPIE²⁸, the construction rate of office buildings over the past years was estimated as about 10-20% a year. This explains why the renovation of existing office buildings has not been of high interest. In general, our interviewees reported that the mentality of office building owners is still not in general oriented toward life cycle issues. At least until now, owners have mainly renovated at least cost to a minimum acceptable standard. This is based on the – now changing – perception that tenants will not appreciate or be willing to pay for greater improvements. The main barriers to energy renovations in office buildings can thus be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are similar as for other major building owners groups. Conflicting information or mistrust of information and heterogeneous outcomes are rated as critical, for the reasons mentioned above.
- **Financial barriers:** An important barrier is the fact that energy bills usually represent a small part of the overall expenditure of the companies occupying offices. Hence it is very difficult to invest an important amount of money (which is difficult attract on the market) for obtaining savings over a period much longer than those considered by the actual business models. Another explanation is the common fact that for office buildings, the most attractive energy efficiency measure is to invest in demand control and less in thermal renovation. For businesses, there is also unwillingness to incur debt for energy efficiency investments, which are considered passive investments that do not deliver short-term benefits.
- **Organizational problems:** Collective decisions are a problem for many owner-occupied office buildings as a big office buildings may be owned by many companies. A short time-frame of decisions may also be a lesser barrier, as the business environment is very turbulent.
- **Lack of information and skills:** Lack of attention and lack of knowledge are lesser barriers, whereas critical barriers include the lack of reliable advice and the lack of sophisticated financial analysis when it concerns energy renovations.
- **Transaction costs** include one critical barrier, lack of skilled service providers, which pertains similarly to all building owners and has been discussed above. Lesser barriers include high information search costs, concerns over disruption to office activities, as well as risks of failures in renovation.

Our interviewees, however, also mentioned that the situation is changing rapidly and interest in energy issues and office refurbishment is growing due to two factors. The first is the financial crisis, which has led to competition for tenants and competition for investments – neither of which existed when the office market was booming. Investors such as large funds are more discriminating in what they include in their portfolios. Similarly, tenants are more aware of rising service charges, and they can chose from several available office spaces. Buildings with low operating costs are easier to fill up with tenants.

Our interviewees also reported that partly due to the increased competition and partly due to rising awareness, green certificates like LEED and BREAM have made a breakthrough, and they report that there are more than 100 renovations ongoing that aim for certification. However, most of these developments are in Bucharest and the 2nd tier cities: the barriers are bigger in areas that are further from the business centres.

There is also an initiative underway by Romanian Green Building Council to recognize energy renovations in property taxes. This has already been enacted in the municipality of Cluj-Napoca: the property tax for energy efficient buildings is reduced by 50%. The property tax is not large by European standards, but still hundreds of thousands of euro for a large building, according to our interviewees. Normally, when a building is improved, the property tax basis is raised. The initiative aims to encourage energy renovations by keeping the tax level effectively at its original level through the deduction for energy efficient renovations, while offering an even larger tax base for the municipality by stimulating employment.

²⁸ Personal communication from BPIE

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria in office buildings:

- **Financial criteria** are dominant in a business environment. However, compared to ordinary dwelling owners, business professionals are likely to place an equal importance on return on investment as on initial costs, expected energy cost savings and payback times. Our interviewees argued that the role of initial costs was predominant previously, but this is rapidly changing.
- **Ease of renovation** is important, including the availability of good quality services, quick installation and turnkey solutions. However, one of our interviewees reported that the value of time is somewhat less appreciated in Romania than in Western Europe.
- **Lifetime and risk considerations:** The decision time frame is usually relatively short and businesses want to focus on their core activities. However, our interviewees reported that time horizons have grown, from about 2 to about 5-7 years. Issues like ease of maintenance should be important, but are nonetheless not yet high on the decision agenda.
- **Other benefits:** However, improved comfort may be relevant for building users, but not a key criterion for owners. However, our interviewees argued that improved value of the property is gaining in importance due to the heightened competition for tenants and the rising service charges. While there is a growing interest in green buildings, issues like location are still much more important (Purice 2012), hence social approval or status are not among the most important criteria.
- **Environmental and societal motives and pressures** are not a priority for Romanian office building occupants in general, as they have several other priorities. Expected future regulations are not seen as presenting major pressures for building renovation; however, recommendations by experts (e.g. consultants) have a medium-level role in decisions.

11.3 Discussion on barriers and drivers of energy renovations

Awareness and interest in energy renovations appear to be growing rapidly in Romania – albeit from a low starting level and under severely difficult conditions. Because of the poor initial condition of most buildings, there are many opportunities for improvement.

The financial barriers to large-scale renovation activity are difficult, but there are also other barriers, which are summarized across owner groups in Table 11.2. Apart from initial costs and payback times, also the cost of capital is a problem as interest rates are generally high – these are barriers shared by all owner groups. Owner-occupied apartment buildings also have great difficulties in reaching decisions, as the decision making in condominiums is poorly organized: all owners need to sign a mortgage in order to get funding for renovating the building as a whole. Because of this, renovations require significant external funds. Organizational barriers are also widespread in the public administration.

Our experts also highlighted lack of reliable advice and unsophisticated financial analysis as widespread barriers. One suggestion for improving this situation was to monitor the newly renovated buildings and thus offer real-life examples of the costs and benefits of accomplished renovations. The lack of skilled service providers was also brought up as a widespread barrier. There are efforts underway to start a broad training programme under the IEE-funded BUILDUP skills programme, but several issues remain to be solved. An additional barrier mentioned as important for residential customers is the (still) low price of energy, which detracts from the financial attractiveness of energy renovations.

Table 11.2. Most widespread and critical barriers to energy renovations for the different owner groups in Romania (critical barriers marked red, less critical ones marked orange).

	single-family homes	owner-occupied apartments	social rental	state-owned public buildings	municipal public buildings	offices
Genuine uncertainties regarding cost effectiveness						
Conflicting information, mistrust of information						
Heterogeneous outcomes						
Uncertainty concerning measurement & verification						
Financial barriers						
High initial costs						
Long payback time						
Access to/cost of capital						
Unwillingness to incur debt						
Occupant take-back						
Low/uncertain resale value of property						
Organizational problems						
Landlord-tenant dilemma						
Collective decision problems						
Short timeframe of decisions						
Public budgeting practices						
Lack of information and skills						
Lack of customer attention and interest						
Lack of customer knowledge						
Lack of reliable advice						
Unsophisticated financial analysis						
Transaction costs						
Lack of skilled service providers						
High information search costs						
Switching costs, concerns over disruption						
Risks of failures in renovation						

Source: interviews and literature as presented above.

In spite of these barriers, there are also several drivers for energy renovations. The rising price of energy, increasing awareness and public discussion, and the determined efforts of the mayor of Bucharest Sector 1, who announced to complement the existing thermo-rehabilitation program for multi-family buildings with another local program for housing renovation, sustainable regeneration of the Sector as well as to upgrade the public buildings towards low-energy/nZEB levels, were mentioned as important factors by our interviewees. On the basis of this review, the main parties influencing renovations are the following:

- **Public authorities** play a key role in promoting renovations. The available funding schemes are very generous and this aim to surmount the lack of funding by building owners and the high interest rates and stringent loan requirements of banks. Municipalities also often offer technical support for multifamily apartments, which are not usually capable of organizing renovations on their own.

Public authorities also have an important role in renovating public buildings and thus accumulating experience and competence in the sector.

- **International financial institutions** and the EU have played a large role in raising the issue and launching programmes and funding schemes for energy renovations. Examples include the programmes run by the UNDP/GEF Energy Efficiency Financing Team and growing role of European structural funds.
- **Companies offering solutions:** Until now, the domestic building industry has not been well developed and there have been quality problems, which are gaining increasing attention in the media as experiences from renovations accumulate. Training and development programmes like BUILDUP skills can play an important role in the future.
- **The media** has an important role in awareness raising and e.g. reporting on new funding opportunities and experiences in renovation.
- **Associations:** Industry associations and associations of cities as well as NGOs were also mentioned as parties influencing the conditions for energy renovations. One example is the Romanian Green Building Council, which has been active in e.g. promoting building certification and the property tax deduction, as well as in showcasing successful examples.

As concerns decision criteria, there are a few criteria that are highly important for all owner groups (Table 11.4.2). These are the financial criteria of initial cost and payback times, whereas mainly owners of larger buildings or building stocks use sophisticated measures such as return on investment. For them also, criteria like quick installation are important to avoid interruptions in building use. Smaller building owners place more value on aspects like widely used solutions. Their main interest is to gain a comfortable living environment, hence improved comfort is an important decision criterion.

Table 11.4.2 Most important decision criteria for the major building owner groups in Romania

	single-family homes	owner-occupied apartments	social rental	state public buildings	municipal public buildings	office buildings
Financial						
Initial cost						
Payback time						
Return on investment						
Ease of renovation						
Quality service available						
Quick installation						
Turnkey solutions available						
Lifetime and risk considerations						
Timing vis-a-vis previous renovations						
Ease of maintenance						
Widely used solution						
Other benefits						
Improved comfort						
Improved value of property						
Social approval/status						
Environmental/societal motives/pressures						
Environmental considerations						
Expected future regulation						
Recommendation by experts						

Source: interviews and literature as presented above.

12 Spain

12.1 General overview

The building stock consists of an estimated 10.2 million buildings, nearly 9.5 million of which are residential buildings. Spanish homes consume 17% of Spain's final energy.

The housing stock includes approximately 25 million dwellings (Cuchi & Sweatman 2011). More than 60% of these were built before 1980, when there were no technical standards or codes to regulate the quality of buildings: 44% of buildings were built between 1960–1980, 41% between 1900–1960 and 15% before 1900. More than 1.2 million primary dwellings built between 1960–1980 have deficiencies in their conservation and service status, which makes them especially interesting in terms of upgrading their technical systems (Cuchi & Sweatman 2011).

A special feature of the housing stock in Spain is the large share of secondary residences. There are about 8 million secondary residences, which are unused or empty some part of the year (Tragopoulos & Sweatman 2012). Primary residences accounted for 65% of the built housing stock (Cuchi & Sweatman 2011), and these constitute a more promising potential in terms of energy savings and renovations (Tragopoulos & Sweatman 2012).

In Spain, the Ministry of Industry, Tourism and Commerce (MITyC) manages overall energy policy. Energy efficiency policy is coordinated and guided by the resources and technical leadership of the Energy Diversification and Savings Institute (IDEA, Instituto para la Diversificación y Ahorro de la Energía,) in conjunction with the autonomous regions (Sweatman & Managan 2010).

The energy efficiency policies are defined in the Strategy for Energy Savings and Efficiency 2004–2012 (E4), Energy Efficiency Action Plans (PAEE 2008–2011; PAEE 2011–2020) and the Plan to Activate Energy Savings 2008–2011 (Tragopoulos & Sweatman 2012; Sweatman & Managan 2010). The building policies for energy efficiency mainly draw on regulatory and legislative measures such as Building Technical Code 2006, Regulation for Buildings' Thermal Installations 2007, Regulation for Buildings Energy Efficiency Certification 2007, State Plan for Housing and Renovation 2009–2012 and Plan 2000ESE concerning Energy Service Companies (Tragopoulos & Sweatman 2012, 11). One of the success stories was the adoption of mandatory solar thermal installation as part of the building code. There have also been several campaigns to promote building insulation the replacement of boilers (Sweatman & Managan 2010).

As a part of Spain's Energy Efficiency Action Plan, provincial governments allocate grants or preferential loans to support the energy efficiency in buildings. Four types of measures have been implemented in the existing residential and public building sector (EURACE 2010):

- Grants or preferential loans have been granted for rehabilitation of the thermal envelope of existing buildings. The objective is to reduce the energy demand of heating and cooling by means of application of energy-efficiency criteria in the rehabilitations of buildings thermal envelope.
- Energy rating enables owners to compare energy-efficiency of buildings, which aims to encourage investments in energy efficiency.
- Measures have focused on improving the energy efficiency of existing thermal installations. Public support is given to energy actions that allow reduction in the consumption of conventional energy.
- Measures have been taken for improving the energy efficiency of existing lighting equipment.

Our interviewees stressed that an overriding issue currently influencing is the financial crisis, which has made banks very cautious in their lending. This has greatly reduced all construction activity, including renovations. Moreover, energy use has declined sharply due to overall declines in income and consumption levels. Fuel poverty is an increasing problem in Spain in the current situation.

Table 12.1 presents an overview of the main Spanish building owners and decision makers by building type. A noteworthy factor is the large share of the owner-occupied part of the housing stock (Cuchi & Sweatman 2011; Tragopoulos & Sweatman 2012). We also highlight the secondary residences, because they constitute a large share of the building stock in Spain. The major types of building owners, their decision structures and barriers and drivers are then presented in the next section.

Table 12.1. Major owners and decision makers for residential, public and office buildings

Building and owner type	Share of total building area, % ²⁹	Decision makers and types of owners
Single-family detached		
Owner-occupied and rental	18	Owners individually: private households
Apartment buildings		
Owner-occupied	33	Owners collectively
Rental	3	Private + social housing
Public buildings		
State, regional and local government	n/a	Owners: state and local government
Office buildings		
Including public and private offices	3	Public sector, companies, professional property management companies
Other		
Secondary residential homes (second homes, empty buildings)	27	Owners, including foreign nationals and banks
Other	16	
Total	100	

Source: Ministry of Public Works and National Statistical Institute (INE). Note: these figures differ from the ENTRANZE database because second homes and empty buildings are included.

12.3 Barriers and drivers of energy renovations among major building owner groups

12.3.1 Owner-occupied single-family homes

This section discusses both detached and attached owner-occupied single-family homes (in total, 18% of the building stock by floor area). This group can also include a certain share of rental single-family homes, but these are usually owned by private persons (Blas Lopez 2004), and are not hence discussed separately here. Of this detached houses are a smaller group than the attached houses. In detached houses, owners make energy investment decisions as a private household and individually.

This is also the case in attached single-family homes, as a rule. However, there may be common parts of the property in some cases, and some buildings are part of a community of property owners. So, there are some issues on which agreement by neighbours may be needed. Moreover, all decisions which affect the aesthetics of the façade need the permission of the city council.

The main barriers to energy renovations in owner-occupied single-family homes can be summarized as follows:

²⁹ These are different from in ENTRANZE D2.1 because also the secondary buildings are included, because they constitute such a large share of the housing stock.

- **Genuine uncertainties regarding cost-effectiveness** are not the most critical barriers. However, conflicting information and mistrust of information, heterogeneous outcomes of energy renovations and uncertainty concerning measurement and verification of energy savings are deemed minor barriers. Our experts indicated that even with all the years campaigns undertaken by government, industry and civil society, awareness of cost-effective energy saving opportunities is still low. The issue is exacerbated by rapidly advancing technological development, where it can be difficult even for professionals to keep abreast of prevailing best practice. Our experts also reported that homeowners can be skeptical about implementing new solutions, especially if two or more professionals give supposedly conflicting advice as to the best way to renovate.
- Especially **financial barriers** are critical to owners of detached single-family houses. High initial costs of energy renovations are a critical barrier (Beillan et al. 2011). The owners of single-family detached homes include families with low incomes, who have little economic capacity. Most of the aid is received at the end of the project, which requires finance. Access to capital is not easy and energy renovations have long payback time in Spain. Home-owners are also unwilling to incur debt because of the threat of unemployment. Also the low or uncertain resale value of property can in some cases be a barrier to energy renovations.
- **Organizational problems** are not usually a problem for single-family home owners. However, in the case of attached homes, some issues might need to be agreed on among neighbours. Organizational barriers may also relate to public budgeting practices, which are a critical barrier because of the current economic situation in Spain. According to experts, at the present time the existing grants are being in fact reduced or eliminated.
- **Lack of information and skills** are deemed lesser barriers single-family homes, including lack of customer attention and interest, lack of customer knowledge, lack of reliable advice and unsophisticated financial analysis.
- **Transaction costs** are not severe barriers for single-family detached home-owners. However, lack of skilled service providers is deemed a lesser barrier. Our interviewees reported that there is shortage of experts in the renovation sector, and that companies offering services rarely have an integrated view of energy renovations.

For single-family home owners, renovations are mainly driven by the need or desire to maintain or improve comfort levels, as well as the desire to save on energy costs (Beillan et al. 2011). The change of ownership can also be an occasion when renovations become topical, according to our interviewees. According to a survey by GfK Consumer Tracking (2010), about 34% of Spanish homeowners felt their property needs to be renovated (which is less than other countries).

There have been several campaigns to promote energy efficiency, but not yet from a whole building perspective (Sweatman and Managan 2010). Moreover, grants and preferential loans are offered and distributed by the autonomous regions (IDAE 2012). There have also been significant efforts to develop comprehensive service offerings including finance for e.g. renewable heating systems (IDAE 2012). However, according to our interviewees and MARIE (2012), aesthetics, increased space, noise and comfort are main drivers for home refurbishment, and the energy efficiency communications by public authorities fail to connect with these concerns.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** like initial cost and payback time of energy renovations are rated as the most important decision criteria concerning energy renovations for detached house home-owners. These relate to the affordability of the renovation (Beillan et al. 2011). Return on investment is less important, as homeowners rarely calculate such sophisticated measures.
- **Ease of renovation:** Quick installation is deemed somewhat important (depending on whether renovation is done in the context of a change of occupancy), and the quality of services and the availability of turnkey services are likely to have some effect on owners' decisions (Sweatman and Managan 2010).

- **Lifetime and risk considerations** are also important decision criteria for owners. This is especially the case as concerns the ease of maintenance of the new energy solution. In their decisions on energy renovation solutions, owners prefer widely used solutions rather than innovative ones.
- **Other benefits:** Improved comfort is a major driver for energy renovations in single-family homes (Beillan et al. 2011). Improved value of property can be important for some home-owners.
- **Environmental and societal motives and pressures:** Recommendations by experts and expected future regulation has some weight in owners' decisions. Environmental criteria have a smaller role.

12.3.2 Owner-occupied apartment buildings

Owner-occupied apartment buildings are the largest residential building group in Spain. About 33% of total building stock consists of such multifamily homes.

The distinctive characteristic of this building group is that decisions are made collectively by residents in the residents' general assembly ("community of property owners", and require a majority of more than half the owners. Decisions can be influenced by the building administrators, which are required by law to have a professional certification. Renovation funds are not compulsory and are rarely used, according to our interviewees.

Our interviewees also reported that decision making in apartment buildings is often not well organized, in spite of the existence of formal rules and procedures. The residents are not used to working together, and interests are diverse. Moreover, even though only a simple majority is needed to make decisions on renovations, banks do not give out loans to the community of property owners, but require each resident to mortgage their own apartment.

A relatively large share of this building stock is owned by low-income households. In Spain, social housing needs are primarily not provided for through rental housing but owner-occupied housing with state support for construction costs (CECODHAS 2012). More than 2.7 million (11.5%) Spanish homes are state sponsored homes for people with economically poorer conditions. In these cases, owners are unlikely to have resources to invest in refurbishment (Tragopoulos & Sweatman 2012).

The main barriers to energy renovations in owner-occupied single-family homes can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are relatively minor barriers. However, our interviewees mentioned distrust of information and savings calculation as a lesser barrier, and heterogeneous outcomes are also deemed a small barrier.
- **Financial barriers** are the most critical: According to our interviewees, they are closely linked to the organizational barriers, i.e., difficulties in reaching agreements to face investment on energy renovations and difficulties in accessing capital. Hence, initial costs are often an insurmountable barrier, which is also due to the fact that most of the aid is received at the end of the work³⁰. Hence, owners have to cover fairly high upfront costs. The condominium co-owners often include retired people and families with low income, who have little economic capacity and access to capital. A second critical financial barrier is the long payback time of energy renovations (DEMOHOUSE 2007). Today, unemployment is real threat to home-owners and they do not want to incur or increase debt. The low or uncertain resale value of the property can also be a lesser barrier, because the prices of property are currently declining in Spain. In this situation, investing in renovations is not very profitable.
- **Organizational problems** include critical problems in collective decision-making and the distribution of government aid for renovations. Our interviewees stressed the poor organization of condominium associations, which makes it very difficult to reach agreements about major investments. Residents can include groups with very different interests and socio-economic

³⁰ One of our interviewees also reported that sometimes the aid is not received for years after the renovation is completed, even though the grant has been initially approved. This presents a high risk for both the residents and the contractors.

positions (DEMOHOUSE 2007). In Spain, many central heating facilities in the dwellings of the 1940s-1970s lack individual energy consumption meters. The payment is made by surface quota, which discourages saving energy and making investments in energy saving renovations. Some multi-family buildings have other renovation priorities to face because of poor living conditions (DEMOHOUSE 2007). Our interviewees also stressed the problems caused by difficulties in accessing finance and the delays in receiving granted government contributions. Moreover, there are concerns that government support is being reduced or eliminated in the current financial situation.

- **Lack of knowledge and skills** are rated according to experts as contributory barrier. This is due to lack of information and advice on energy management and energy usage of buildings for administrators and residents (DEMOHOUSE 2007). Customers know little about the thermal conditions of dwellings and normal consumption rates. Apartment owners lack information on alternative technical solutions or on the profitability of energy improvements. Homeowners also lack information on subsidies and tax incentives and financial analysis of energy investments.
- **Transaction costs** include one contributory barrier. The lack of skilled service providers is a problem in Spain, because there is shortage of experts in this area. Also the lack of integration of environmental criteria in the sector is a problem (Beillan et al. 2011), which was stressed by our interviewees, as well.

Our interviewees stressed that renovations are usually made because building components are reaching the end of their lifespan (e.g. heating systems), or some improvement is deemed otherwise necessary (elevator installation, plumbing repair). These are opportunities for building professionals to suggest the inclusion of energy improvements. However, they reported that condominium owners rarely seek for these solutions themselves.

Energy savings, better comfort and living quality are the main drivers of energy renovations. However, in collective housing, the role of improving the value of property can also be a major driver for renovations (Beillan et al. 2011). Support programmes by the provincial or local government have also had an important role in collectively owned owner-occupied housing (Beillan et al. 2011), which was also highlighted by our interviewees.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial drivers** are rated as the most important. The most important decision criterion is the initial cost of renovations. According to our interviewees, payback time is also important, and e.g. heating systems are replaced more easily than insulation due to the shorter payback period.
- **Ease of renovation:** Easy and quick installation is a quite important factor in the decision making in owner-occupied apartment buildings. The quality of the available services and the availability of turnkey solutions play a lesser role.
- **Lifetime and risk considerations:** Timing is of critical importance and building components are not replaced before the end of their lifespan. Our interviewees also reported that the ease (and cost) of maintenance is an important factor in energy renovations, as is the availability of widely used solutions. As a group, condominium owners tend to be rather conservative in their decision making.
- **Other benefits: Improved comfort is one of the major drivers of renovations, including energy renovations.** Improved value of property can be important for at least some homeowners (Beillan et al. 2011). Social approval or status of energy solutions less important.
- **Environmental and societal motives and pressures:** Environmental considerations or expectations concerning future regulations were not deemed important factors by our interviewees. However, they had noticed that recommendations by experts have some influence in decision making by condominium associations.

12.3.3 Rental apartment buildings

Rental apartment buildings are either commercial and co-operative or social rented multi-family homes. Social rental apartments are only a small share (15%) of the rental housing stock (CECODHAS 2012). Most rental apartments are privately owned and many are co-located in condominiums along with owner-occupied apartments (Blas Lopez 2004).

In the case of rental buildings, owners make the decision on energy renovations. If rental buildings have more than one owner, more than half the owners need to vote for the decision. In rental dwellings, tenants are consulted about the decisions beforehand, but they do not have a veto in renovations. Tenants can also be authorized by owners to make the decisions concerning the dwelling on behalf of them.

According to our interviewees, an important factor influencing the owners' decisions is the regulation of rent levels. In private rental markets, rents are not regulated but cannot be increased beyond the consumer price index during the five-year lease (Blas Lopez 2004). In social housing, maximum rent levels are set by the regional government annually and cannot be exceeded even due to investments in renovations. Hence, our interviewees reported that energy renovations are not financially profitable for the building owners.

The main barriers to energy renovations in owner-occupied single-family homes can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are contributory barriers to energy renovations in rented multi-family homes. Same barriers associated with conflicting information and mistrust of information exists among owners of rented residential buildings both in commercial or co-operative and social side.
- **Financial barriers** are the most critical barriers to energy renovations also in rented multi-family homes. One critical financial barrier is occupant take-back, which means that after the renovation tenants will increase comfort level and no savings will accrue. According to experts, to this date the value of rentals in Spain does not depend on the energy rating of housing as in many other countries in Europe. Because of this, the owners' investment in energy improvement of their rented dwellings is not profitable because they do not gain any returns on their investment. Other critical financial barriers are the same as in case of other residential building types: High initial cost, long payback time, owners' access to capital and the owners unwillingness to incur debt are main barriers. Also low or uncertain resale value of property is rated as contributory financial barrier.
- **Organizational problems:** According to our interviewees, the landlord-tenant dilemma is a major barrier. Collective decision problems are also barriers, as the majority of rental dwellings belong to private owners, so the intervention depends on the individual initiative and on the agreement among common property owners. Another contributory barrier is short timeframe of decisions (especially among private owners). Administrative barriers are also significant: permitting and the obtaining of grants is difficult due to complex administrative structures (RESHAPE 2009; Travezán 2012)
- **Lack of information and skills** are also same kind of contributory barriers in rental as in owner-occupied homes.
- **Transaction costs** are a contributory barrier in terms of lack of skilled service providers. This is likely to be less critical for social housing owners, however, as they own and professionally manage large building stocks.

In the case of rental social housing, in principle the responsibility for renovation and maintenance lies with the public social housing companies. However, the initiative for renovations often comes from tenants, who can send a call for action to the building manager, which evaluates the request and decides on the renovation works (RESHAPE 2009). Major drivers are the need to improve living conditions and reduce energy costs. Our interviewees reported that the large social housing organizations are developing targets for energy renovations in response to government pressures to cut CO₂ emissions.

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria** are important to owners of rented dwellings. The most important decision criteria are initial cost and payback time. Return on investment can be important for private rental apartment owners.
- **Ease of renovation** has some weight. Quick installation is quite important criteria especially in rented social buildings, because the need to move residents can be a major problem and cost factor (RESHAPE 2009). Quality of service available and turnkey solutions have some effect on owners' decision making and our interviewees stated that these are important factors for social housing owners.
- **Lifetime considerations:** Ease of maintenance is also a relevant decision criterion for rented multi-family owners (RESHAPE 2009). Widely used solutions are easier to apply than unfamiliar ones, but large building stock owners like social housing organizations can be more innovative, according to our interviewees.
- **Other benefits:** Improved value of the property is important for both owner types: it can be one of the key decision criteria. Comfort is less important, and social approval is mainly important for social housing owners.
- **Environmental and societal motives and pressures** have relatively little importance to decision making of rented dwelling owners. However, according to our interviewees, public companies like social housing organizations are responsive to expected future regulations.

12.3.4 Public buildings

These buildings are either owned by the state or the provincial or local government. Energy investment decisions are made by state and local government. They are the stakeholders in public buildings renovation decisions, and the state can influence decisions of the provincial or local government through financial means.

According to Spain's Second National Energy Efficiency Plan (NEEAP2 2011), there is considerable energy saving potential in public buildings, but it is difficult to realize in practice due to the presence of a series of administrative, legal, financial and technological barriers. One example is the presence of separate budget lines investments in energy-consuming technologies and for the energy supply of this same equipment. Measures to promote energy services (EPCs and ESCOs) aim to solve this problem with a single energy purchase contract for energy services, the maintenance of the energy-consuming installations and the realization of saving and energy efficiency measures and the use of renewable energy.

According to our interviews, the current budget cuts are making the situation even more difficult. The following presents a summary of the main barriers to energy renovations in public buildings:

- **Financial barriers:** These are severe due to budget cuts, according to our interviewees. High initial costs, long payback times and access to capital are all critical barriers.
- **Organizational problems** are a contributory barrier in terms of collective decision-making problems. According to experts the problem is that there are administrative problems, which hinder the implementation of conservation and energy efficiency measures. It is also a problem that there is no a regional energy agency to encourage and co-ordinate these interventions. In the case of public buildings, there are competing interests in government, which makes achieving savings and energy efficiency more difficult. Also fragmentation of responsibilities and functions (separate budget lines for investments and energy consumption) make energy efficiency improvements difficult to achieve.
- **Lack of information and skills** are in some parts critical barriers to public buildings energy renovations. Public buildings lack energy monitoring and management systems. Lack of customer attention and interests is due to the fact that there is usually no particular responsible person or agency to drive the action plan and to transmit the information of developed action plans. In

general, a lack of customer knowledge is due to a lack of technical personnel in government and especially in local authorities who have specific training in the energy efficiency of buildings. One critical barrier is the lack of reliable advice. Energy audits conducted so far do not consider the potential savings through information and education habits, and only focus on technical aspects. In terms of barriers caused by a lack of information and skills, unsophisticated financial analysis is a contributory barrier. In Spain government has major difficulties to finance investments in energy efficient technologies because access to third-party financing is still nearly impossible.

The main drivers for the public sector are likely to be societal and financial. Some regions and the Spanish government have set specific minimum requirements for public buildings (Molina and Alvarez 2009). Moreover, some of the existing financial support instruments mentioned in the introduction apply to public buildings as well as residential ones (EuroAce 2010).

For example, as part of the Energy Efficiency Activation Plan in Buildings of the State General Administration (Plan 330), the target has been set that buildings of the state administration should cut back their energy use by 20% in year 2016. Within this frame, more than 2600 buildings have undergone an energy audit. Moreover, an Enhancement Plan to Hire Energy Services (ESCOs Plan 2000) also sets similar targets for local and regional authorities' buildings. ESCO projects launched under these plans also receive a subsidy of 15-20% (Rodríguez 2011).

Renovation activities may be further influenced by Plan 2012, which aims to reduce the public deficit. One way to reduce costs is the optimization of public buildings use. The objective is to reduce the cost of rented buildings for public purpose and the Government should employ other building that it owns but does not currently use. A guide for meeting this objective is currently being elaborated (Plan 2012).

On the basis of our review and expert interviews, the following are suggested as the most important decision criteria:

- **Financial criteria:** The most important decision criteria are likely to be financial. Initial costs, payback times and returns on investment are all major decision criteria.
- **Ease of renovation:** The public sector can use its own competence and market power to gain suitable services. However, the availability of good quality services can be decisive, because it reduces the financial and political risks of renovation projects.
- **Lifetime and risk considerations:** Timing is fairly important for the rational allocation of resources and public buildings are renovated following an investment plan or schedule. However ease of maintenance and the availability of widely used solutions are likely to be relatively less important in decisions about public buildings.
- **Other benefits:** improved comfort and social approval have a medium-level importance, as they relate to the building owners' relations with building users and the electorate. On the other hand, improved value of property is not important for the public sector, which usually does not sell its property.
- **Environmental and societal pressures and motives:** Environmental considerations are the responsibility of the public sector, so they are expected to have a medium weight even in the current financial situation. However, expected future regulation and recommendations by experts are deemed less important concerns for the public sector at the present time.

12.3.5. Office buildings

The share of owner-occupied and rental office buildings is unfortunately not known, so they are discussed here as one group. However, our experts report that office buildings are usually owned by often professional property management companies, which make the decisions on energy investments and other renovations.

There is limited pressure and limited policy measures directed at office building energy refurbishment in Spain, according to our interviewees. According to a study by WBCSD (2007), most building professionals

(including professional office property owners) in Spain had some awareness of the importance of sustainability in buildings. However, less than one-tenth had been involved in sustainable building or refurbishment projects. Nonetheless, the costs of heating and cooling systems are driving investments in new solutions, which the building owners actively seek out.

The main barriers to energy renovations in commercial office buildings can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness** are relevant for professional property owners, as they make it difficult to calculate the costs and revenues of investments.
- **Financial barriers** are the most important ones. According to our interviewees, these relate especially to renovations of the building envelope, whereas e.g. new heating systems have relatively short payback times and are hence of greater interest. Uncertainties about the impact of the investment on resale or rental values can also hinder renovations.
- **Organizational barriers** mainly relate to the complex administration of building permits and projects (Travezán 2012).
- **Lack of information and skills:** These are lesser barriers, but also concern office building owners to some extent. As stated above (WBCSD 2007), even professional property managers have little experience of energy refurbishments.
- **Transaction cost:** The lack of skilled available service providers is deemed a contributory barrier, even for professional office space owners.

Major drivers for renovations of office buildings usually relate to the functionality of the building, whereas energy related renovations only make up a small part of such investments (ECI 2012). However, our interviewees suggested that heightened media discussion on e.g. new heating and cooling solutions has raised interest in renewal of equipment. According to one interviewee, office building owners actively search for new solutions, also in response to rising energy costs and expectations of further rises.

- **Financial criteria:** The most important decision criteria appear to be financial. Initial cost and payback time are rated as having a high weight in owners' decisions. In the case of professional office space owners, also return on investment plays a major role in decisions.
- **Ease of renovation** and especially quick installation are important for office space owners.
- In terms of **lifetime and risk considerations**, ease of maintenance is an important criterion.
- In case of **other benefits** especially improved value of property is important.
- **Environmental and societal pressures and motives** are rated as having medium to low weights in decisions about energy renovations. Recommendations by experts are now exerting a growing role, as evidenced by our interviewees comments on the role of media discussion.

12.3.6 Secondary residential buildings

Secondary residential buildings make up 27% of total building stock in Spain (Table 11.2.2.), and are a special feature of the Spanish housing stock. This building type includes secondary homes (which may be unused for large parts of the year) and empty homes (10% of dwellings) (Tragopoulos and Sweatman 2012).

The percentage of secondary homes and empty housing has experienced steady growth in Spain. According to our interviewees, energy renovations are the least likely to occur in this building owner group. Since buildings are not regularly heated, cooled or used, the payback time for investments is in most cases exceedingly long.

The main barriers to energy renovations in secondary residential buildings can be summarized as follows:

- **Genuine uncertainties regarding cost-effectiveness:** Compared to owner-occupied apartment buildings, these types of secondary residential buildings face the same contributory barriers regarding conflicting and unreliable information of energy renovations.

- **Financial barriers:** According to experts, the financial barriers to energy renovations are similar to those in other building types. Access to capital is even more critical than for the other groups, as public funding for the renovation of second homes is not available. The third financial barrier is the owners' unwillingness to incur debt. In case of secondary homes, owners are less unwilling to invest money in homes where they do not live permanently. The low or uncertain resale value of the property can compound these problems, especially as the prices of real estate are currently declining.
- **Organizational problems** can be critical barriers in cases where secondary homes are co-located in condominiums with primary residences, in which case the absentee owners can make the decision making even more difficult for permanent residents.
- **Lack of information and skills:** In second and empty homes, the lack of information and skills are similar barriers as in other owner-occupied buildings.
- **Transaction costs** are a contributory barriers in terms of lack of skilled service providers.

This building type is likely to be particularly difficult in terms of promoting energy renovations, and there are no visible drivers for energy renovations under present conditions (Adjarova et al. 2011). Moreover, low occupancy levels mean that energy costs are not a major driver for owners (see Cuchi and Sweatman 2011). None of the literature reviewed or the experts interviewed have suggested any particular drivers for energy renovations in this category of buildings.

If renovations for some reason and in some way were to be stimulated or enforced, the **financial criteria** would be likely to be the dominant ones. Since banks are major owners of empty buildings (one-third of the buildings in this category), return on investment is likely to be on par with the other financial criteria. **Ease of maintenance** and the **availability of widely used solutions** could also be important criteria. **Improved value of property** is likely to also be a major criterion in the case of renovations.

12.3 Discussion on barriers and drivers of energy renovations

The current situation in Spain does not appear to be encouraging for the promotion of energy renovations. While the government has taken several measures and NGOs have been actively advocating for a more forceful renovation policy, current investment levels are low and there are many severe barriers. Among these, our interviewees and several commentators (e.g. Travezán 2012; WWF 2012) have emphasized the administrative complexities and delays and the poor organization of condominium owners' access to finance (i.e, the need for mortgages by all owners) as the most significant ones. These are very important issues because owner-occupied apartments constitute almost half of the entire building stock considered here (and also many of the rental apartments are located in condominium buildings).

Across all building owner types, financial barriers are the most widespread, including high initial costs, long payback times, access to capital and the cost of capital, as well as the unwillingness to incur debt under conditions of financial uncertainty (Table 12.2). The organizational problems of condominium owners were already mentioned above: in addition to difficulties in accessing finance, there are also conflicts of interest and renovation projects often require professional mediation and the help of external parties. Moreover, our experts were of the view that secondary buildings face similar barriers as the others but to a greater extent: moreover, the absence of any current drivers makes this segment of the building stock very unlikely to undertake major renovations under any foreseeable circumstances.

Table 12.2. Most widespread and critical barriers among different building owner groups. Barriers rated critical are indicated in red and less critical ones in orange.

	Single-family homes	Owner-occupied apartments	Rental apartments	Public buildings	Office buildings	Secondary residences
Genuine uncertainties regarding cost effectiveness						
Conflicting information, mistrust of information						
Heterogeneous outcomes						
Uncertainty in measurement/verification of saving						
Financial barriers						
High initial costs						
Long payback time						
Access to/cost of capital						
Unwillingness to incur debt						
Occupant take-back						
Low/uncertain resale value of property						
Organizational problems						
Landlord-tenant dilemma						
Collective decision problems						
Short timeframe of decisions						
Public budgeting practices						
Lack of information and skills						
Lack of customer attention and interest						
Lack of customer knowledge						
Lack of reliable advice						
Unsophisticated financial analysis						
Transaction costs						
Lack of skilled service providers						
High information search costs						
Switching costs, concerns over disruption						
Risks of failures in renovation						

Source: interviews and literature as presented above.

Nonetheless, most authors argue that a concerted chain of stakeholders supporting renovations could help to make a breakthrough in energy renovations. The following stakeholders have been identified as important (WWF 2012; Cuchi & Sweatman 2011; Tragopoulos and Sweatman 2012; Travezán 2012; MARIE 2012):

- **Public bodies:** Many instruments are in place to promote energy renovations but they do not seem to be reaching their goals under current circumstances. Several innovative policy instruments have been recently suggested. These include for example fiscal instruments such as tax deductions for energy investments, as well as the provision of upfront finance via ESCO-type solution. There also seems to be a need for more convincing and tailored communication on the benefits and procedures of energy renovations.
- **Companies offering solutions:** Several commentators suggest that training and certification measures are needed to offer an appropriate package of services. On the other hand, because

building owners face difficulties in raising finance, also contractors can face risks in offering comprehensive services.

- **Banks:** Banks might play an important role under different circumstances. There is a clear need for long-term low-cost loan products that could lever public funding.
- **Energy companies:** There is no energy efficiency obligations scheme in Spain. However, several commentators have suggested that such a scheme would be necessary in order to raise the necessary capital, and it could also provide a way to recover upfront finance via energy bills.

Table 12.3 presents the most important decision criteria for the major building owner groups. Initial costs are likely to be relevant criteria for all groups of building owners, and many would also examine payback times. Timing is likely to be important for all larger building types, as renovations are usually made in response to the technical need to renovate the building or its parts. Improved value of property is also relatively relevant for several building owner types, as there is a surplus of property for sale in Spain. In other respects, the criteria reflect the specific situations of particular owners, including their knowledge levels and the average condition of different types of buildings.

Table 12.4.2 Most important decision criteria for the major owner groups. Source: interviews and literature as presented above.

Criteria	single-family homes	owner-occupied apartments	private rental apartments	social rental housing	public buildings	office buildings	secondary residences
Financial							
Initial cost							?
Payback time							?
Return on investment							?
Ease of renovation							
Quality service available							
Quick installation							
Turnkey solutions available							?
Lifetime and risk considerations							
Timing vis-a-vis previous renovations							
Ease of maintenance							?
Widely used solution							?
Other benefits							
Improved comfort							
Improved value of property							?
Social approval/status							
Environmental/societal motives/pressures							
Environmental considerations							
Expected future regulation							
Recommendation by experts							

Source: interviews and literature as presented above.

13 Summary and conclusions: Similarities and difference among countries and owner groups

13.1 Structure of ownership and decision making

There are significant differences in the structure of ownership and decision making among the target countries. Our analysis has highlighted these differences pertaining to residential buildings, public buildings and offices.

Owner-occupied single-family homes are the only category that is fairly similar in all countries. Shares range from 20 – 57% of the total building area³¹. However, there are differences in owner demographics and sub-categories of owners, some of which could not be captured in our analysis. In several countries, owner-occupied single-family homes are the most dominant and normal type of home in urban (or at least suburban) areas, whereas in others, they mainly occur in rural areas and in wealthy suburban villa areas. So the homogeneity between countries to some extent masks heterogeneity within countries. We have tried to capture this diversity to some extent through sub-categories, which are presented in the specific country chapters.

In contrast, the share of rented single-family homes varies greatly (and unfortunately is not known for all target countries). At their greatest, they amount to 9% of the total building area, whereas the smallest shares are 0%. These are in most cases owned by private individuals.

The differences in ownership structure are much greater still in multi-family buildings. Here, some countries have a predominant share of owner-occupancy (Table 13.1). Further, the structure of decision-making within owner-occupied apartment buildings varies greatly. This pertains to the majorities needed for making decisions on renovations to the ability of co-owners to obtain loans for renovations, to the existence and usefulness of renovation funds, and to the level of professionalism with which buildings are managed. A particular problem highlighted in our study is that in several countries, even when a simple majority is required to make decisions, the financing of the investment with a bank loan may require that all owners mortgage their own apartments. In all of the countries, however, in owner-occupied apartment buildings, lay people make decisions on very large and very challenging investments when they decide about renovations of the entire building.

In general, co-ownership of multi-family buildings is a problem that has received insufficient attention in the European discussion on energy renovations. It seems that simple measures, such as grants for renovations, are often not sufficient to stimulate energy renovations even in countries where they are extremely generous. Issues such as decision making rules, repair and maintenance funds, tailored financial services and professional maintenance and repair plans also need to be addressed. The picture is further complicated by the fact that in some target countries, a relatively large share of the rental apartments are owned by private persons with one or a few rental apartments that are co-located in buildings with owner-occupied apartments.

³¹ This includes also residences that are not permanently occupied. These are included here in the case of Spain because they constitute such a large share of the total housing stock, and can also influence other owner groups.

Table 13.1. Share of owner-occupancy in multifamily housing and required majorities for decisions and investments

	Share of owner-occupied of multifamily dwellings %	Type of ownership ³²	Required majority for decisions on renovations, %	Other factors influencing renovations
Austria	23	unitary system	>50% of shares, but minority rules	The minority rules. Mandatory renovation fund usually not big enough. Joint loans have a big administrative burden.
Bulgaria	90	condominium ownership/unregulated	>67% (of area)	All buildings do not have a homeowners' association. When no homeowners' association is established, each owner needs a separate loan for the renovation.
Czech Republic	79	condominium ownership	>75% of votes	Banks usually require that all apartment owners mortgage their apartments for the loan.
Germany	24	condominium ownership	>50% of shares	Mandatory renovation fund (1% of value of building). Taking out a loan can require a mortgage by all residents.
Finland	50	housing company (similar to unitary system)	>50% of shares	The housing company can take out a loan of its own, once the majority of owners have agreed to it.
France	26	condominium ownership	>50% of shares	Taking out a loan can require a mortgage by all residents.
Italy	65	condominium ownership	>50% of shares (for energy investments)	Dissenters can move to delay the implementation of decisions with significant financial consequences.
Romania	96	condominium ownership?	>67%	Taking out a loan can require a mortgage by all residents.
Spain	86	condominium ownership	> 50% of shares	Can be less for renewable energy (1/3), but those voting against cannot be charged. Taking out a loan can require a mortgage by all residents.

Source: own compilation, references presented in previous chapters

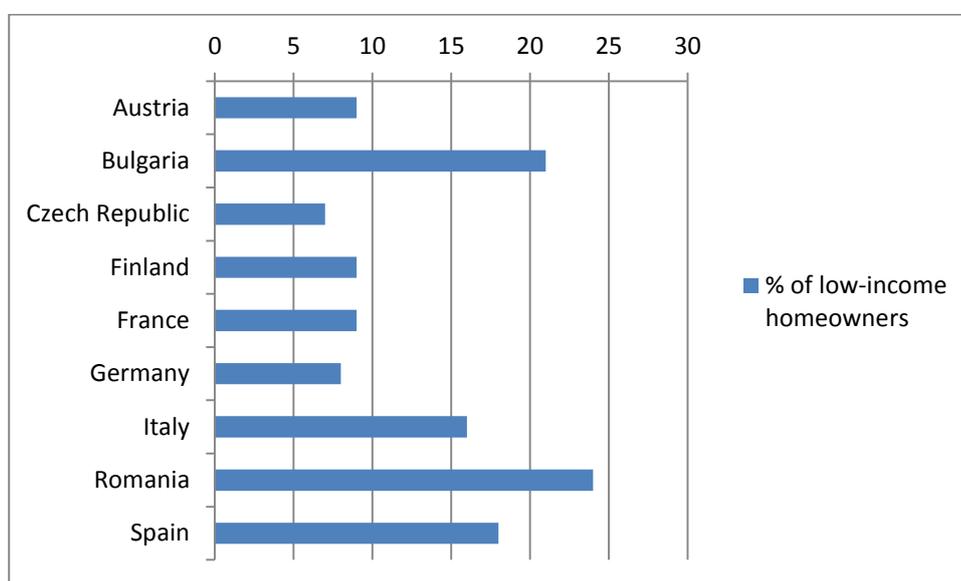
Studies show that there is a great deal of inertia in the **owner-occupied multifamily buildings** due to the **decision making structure**. In most countries, there are majority rules for decision making. Reaching the majority may be extremely difficult because studies show that on average 25 % of owners are not usually taking part in the meetings where decisions are made. The majority is usually calculated based on total votes or total shares and not on those present at the meeting. It can be assumed that the absentee owners are not opposed to proposals (otherwise they would participate the meeting). Thus, the absence of these indifferent owners makes reaching the necessary majority very difficult. Therefore, if these indifferent owners could be activated in taking part on the management meetings or if the majority regulations would be formulated so that the majority present in the meeting has the sufficient powers to make the decision, the energy renovations of these buildings could be stimulated.

³² The unitary system refers to an undivided apartment building, of which owners own shares. Condominium ownership refers to a system where the owners own their dwelling and all owners jointly own the common parts and the land (Lujanen 2010).

A particular problem is **owner-occupancy by low-income households**. There are low-income homeowners in all the target countries; however, the significance of this depends on both the overall share of owner-occupancy and the share of low-income households among owner-occupants (although these are naturally to some extent correlated where owner-occupancy is particularly widespread). As we have seen in the previous chapters, the overall share of owner-occupants varies from less than 60% in Austria and Czech Republic to more than 80% in Spain, Bulgaria and Romania (with Finland, France and Germany having a share that is between 60 and 80%).

Figure 13.1 shows the share of low-income households among owner-occupants in the ENTRANZE target countries in 2008 according to data collected by Dol and Hafner (2010), with low-income defined as earning less than 60% of the median income³³. Problematically, in countries where almost everyone is a homeowner, the share of low-income households among homeowners is particularly high (and the total group is thus large). Low-income homeowners are unlikely to be eligible for commercial retail loans because their income is not sufficient to pay for the monthly repayments.

Figure 13.1. Share of low-income homeowners in the ENTRANZE target countries



Source: Dol and Hafner (2010) Housing Statistics in the European Union

Other problematic categories of building owners include **elderly people and pensioners**. These were often mentioned by our expert interviewees or in the literature as owner types that are less likely than others to make major renovations. There are several reasons for this, such as shortened time-horizons (they are unlikely to benefit from renovations during their lifetime or time living independently at home). On the other hand, some renovations can be necessary for them to adapt to living at home with disabilities. In many countries, pensioners have difficulties gaining loans (at least larger ones) due to lower incomes and higher repayment risks.

In addition to income, it would also be useful to have data on the value of owner-occupiers' properties (as these would be the collateral for loans for major renovations) and their ratio to the cost of renovations. Our country studies suggest that in several countries, there are areas where the **value of the property is so low that properties are unlikely to be eligible for market-based finance** to invest in renovations. Our interviewees also mentioned buildings that are in **poor structural condition** (e.g. pre-earthquake buildings in Romania) as buildings that might not merit major renovations.

³³ The shares of homeowners might be somewhat different to those used in the present report.

The ownership of rental apartments also differs greatly among the countries examined. In general, in countries where rental apartments are scarce, there are more problems for energy renovations, as the rental apartments only house the very poorest people, and there are legal or practical constraints on adding any of the renovation costs to the rent. In these cases, the landlords are in a very difficult situation, especially as the value of the buildings is low and their future is uncertain. In other countries with a large share of well-established rental social housing providers, energy renovations may be easier to initiate in rental than in owner-occupied apartments, due to the concentration of power, systematic renovation schedules, and e.g. determined public policies (Austria, France, to some extent Finland) and because of the division of costs between tenants and owners (in Finland, heating energy costs are part of the rent, so landlords benefit from energy renovations).

Public buildings also exhibit a great diversity, both among and within countries. One issue is the competences of the state versus municipalities. In many countries, municipalities own a large share of the public buildings, and some of them (especially small municipalities) are in a precarious financial situation. However, the current poor state of public finance is a common problem in all countries at the moment. Moreover, public budgeting procedures and the practice of having separate budget lines for running expenses and investments are widespread problems, as is the fact that investments in energy efficiency have to compete for budget funding with other (often more visible) investments. Some countries have made determined efforts to overcome these problems, for example by supporting and facilitating third-party finance (ESCOs and EPC), which is, however, in an early stage of development at best.

Office buildings are a group that is more homogeneous across the target countries, at least as pertains to professionally owned office rental office properties, which are sometimes even owned by multinational companies operating in several European countries. Even here, however, differences in the market structure and the preferences of the clientele can create some differences. A common issue in most countries, however, is the fact that even energy aware property owners may prefer to take energy efficiency measures in new office buildings and in operations and maintenance, rather than through renovations.

Apart from the differences between buildings types and ownership types, our analysis identified a further, partly related dimension that has relevance for energy renovations and the criteria considered when making such decisions. This is the level of *professionalism* with which buildings are managed. Higher professionalism does not necessarily imply a greater propensity to make energy renovations, but it implies that different decision criteria (i.e., measurement and verification of savings, returns on investment and the financial value of time) are relevant in the decision making process.

13.2 Barriers and decision criteria: similarities and differences

The overall situation in a country creates some conditions that influence all different owner types. For example, in the new member states (Bulgaria, Czech Republic, Romania), the barriers to energy renovations – especially financial and organizational barriers – appear to be more severe than in other target countries. Similarly, the conditions of the financial crisis and the related austerity measures are creating financing problems in Italy and Spain. In a relatively stable financial environment and over a longer period, public policy can however create an overall climate that is conducive to paying attention to energy savings and also stimulating energy renovations (Austria, Germany, France).

Consistent and long-term policies should in principle also create competencies and markets for services that are not exclusive to one particular owner group. However, this is not necessarily reflected in stakeholders' perceptions of transaction costs. Everything is relative, of course, and there are most likely problems in comparing our data across countries (i.e., when the relative importance of a problem like finance declines, other problems like transaction costs become relatively more important). However, it is at least suggestive that we found problems concerning the lack of skilled service providers, high information search costs and risks of renovations in all countries (even those with quite some experience of energy renovations), even though they were not perceived of as equally important in all owner groups.

However, as noted above, the situation of different types of stakeholders (owner-occupiers and landlords of different types of buildings) creates different conditions for making decisions on energy renovations. There are thus some similarities to be observed among some stakeholder types in all target countries.

As an example, Table 13.2 presents the critical barriers for owner-occupiers of single-family homes. We can see that high initial costs are a common critical barrier. Access to capital or the high cost of capital is also a critical barrier in 8/9 of the countries, and long payback times of energy investments are critical in 8/9 countries as well. In contrast, issues relating to genuine uncertainties regarding cost-effectiveness, lack of information and skills, and transaction costs are perceived of differently in the target countries. This is most likely due to the status of the public debate, the availability of off-the-shelf cost-effective solutions, and the accessibility of energy advice (as well as to uncertainties in our data and the relative nature of barriers in different countries). It also likely relates to the status of the housing itself and the owners' expectations: if the original state is poor, for example window replacement can make a big difference (whether or not the exact costs and benefits can be calculated), whereas when the condition is better, there are more genuine uncertainties and more competing solutions creating confusion and transaction costs for homeowners.

Table 13.3 displays the critical barriers to energy renovations for owner-occupied apartment buildings. A common barrier in all countries is the collective decision problem. High initial costs and/or long payback times are also widespread barriers. In general, there appear to be more barriers and problems for this owner category, because the collective nature of the decision requires more detailed calculations, and directs more attention to uncertainties and transaction costs. Some problems, however, are not critical barriers in certain countries: access to capital is not a critical issue in Austria, Finland or Germany, where there are provisions for either reserve funds or collective bank financing.

Social housing, as a third example, is very differently organized in the different countries, and also has a different market position. Table 13.4 shows the most critical barriers to energy renovations in this owner group. They are quite different in the different countries, depending on the size, ownership structure, legal regulation, clientele and financial position of social housing owners. In most (8/9) countries, however, either high initial costs or (more frequently) long payback times present a critical barrier. The landlord-tenant dilemma is another fairly widespread barrier. It is not however a major problem in Austria and Finland due to the way in which costs and benefits are distributed among owners and tenants.

Table 13.2. Owner-occupied single-family homes: The most critical barriers in target countries

		AT	BG	CZ	DE	FI	FR	IT	RO	ES
Genuine uncertain	Conflicting information, mistrust of information	■		■	■	■		■		
	Heterogeneous outcomes				■				■	
	Uncertainty in measurement & verification				■			■		
Financial barriers	High initial costs	■	■	■	■	■	■	■	■	■
	Long payback time	■		■	■	■	■	■	■	■
	Access to/cost of capital		■	■	■	■	■	■	■	■
	Unwillingness to incur debt	■		■	■	■		■	■	■
	Low/uncertain resale value of property				■	■				
Lack of information & skills	Lack of customer attention and interest	■		■	■					
	Lack of customer knowledge	■	■	■		■		■		
	Lack of reliable advice					■		■	■	
Transaction costs	Lack of skilled service providers	■					■	■	■	
	High information search costs	■			■	■	■	■		
	Switching costs, concerns over disruption	■								
	Risks of failures in renovation	■								

Source: Own compilation, see previous chapters

Table 13.3. Owner-occupied apartment buildings: The most critical barriers in target countries

		AT	BG	CZ	DE	FI	FR	IT	RO	ES
Genuine uncertain	Conflicting information, mistrust of information	■	■	■	■		■	■		
	Heterogeneous outcomes	■			■	■	■		■	
	Uncertainty in measurement & verification	■			■			■		
Financial barriers	High initial costs	■	■	■	■		■	■	■	■
	Long payback time	■		■	■	■	■	■	■	■
	Access to/cost of capital		■	■			■	■	■	■
	Unwillingness to incur debt				■			■	■	■
	Low/uncertain resale value of property					■				
Organi-zational problems	Landlord-tenant dilemma			■	■					
	Collective decision problems	■	■	■	■	■	■	■	■	■
	Short timeframe of decisions	■	■							
Lack of information & skills	Lack of customer attention and interest	■	■				■			
	Lack of customer knowledge	■		■		■	■	■		
	Lack of reliable advice		■	■		■		■	■	
Transaction costs	Lack of skilled service providers	■	■		■	■		■	■	
	High information search costs	■			■		■	■		
	Switching costs, concerns over disruption	■	■			■				
	Risks of failures in renovation	■	■							

Source: Own compilation, see previous chapters

Table 13.4. Social/professionally owned rental housing: The most critical barriers in target countries

		AT	BG	CZ	DE	FI	FR	IT	RO	ES
Genuine uncertainty	Conflicting information, mistrust of information		■	■				■		
	Heterogeneous outcomes								■	
	Uncertainty in measurement & verification		■	■				■		
Financial barriers	High initial costs		■				■	■	■	■
	Long payback time		■	■	■	■	■	■		■
	Access to/cost of capital		■				■	■	■	■
	Unwillingness to incur debt		■					■	■	■
	Occupant take-back		■		■			■		■
	Low/uncertain resale value of property				■			■		
Organizational problems	Landlord-tenant dilemma		■	■	■		■	■	■	■
	Collective decision problems		■	■				■		
	Short timeframe of decisions		■	■						
Lack of information & skills	Lack of customer attention and interest		■					■	■	
	Lack of customer knowledge		■	■				■		
	Lack of reliable advice								■	
Transaction costs	Lack of skilled service providers	■						■	■	
	High information search costs							■		
	Switching costs, concerns over disruption	■				■				
	Risks of failures in renovation	■	■				■			

Source: Own compilation, see previous chapters

Public buildings are presented here as a fourth example of similarities and difference among owner groups across countries (Table 13.5). A common problem that does not seem to have been solved in any of these countries relates to public budgeting practices. In particular, this refers to the way in which public-sector organizations have separate budget lines for investments and running costs. Several countries have tried to solve this by using EPC or ESCO contracts, but until now, progress does not seem to have been significant. Another widespread barrier relates to the high initial costs of energy investments (8/9 of the countries). Moreover, even public sector organizations in many countries seem to have problems in accessing capital for investments (especially in the current financial situation).

Other problems seem to be more specific to particular countries and the way in which, for example, energy management and energy investments are organized, as well as the size of contracting units. An additional problem mentioned by several of our interviewees relates to public tendering rules and practices: often, initial cost is the main criteria in the tender, and lifetime costs are difficult to include in the award criteria. One of our interviewees suggested the development of a new standard tendering model that focuses on lifetime costs.

Table 13.5. Public buildings: The most critical barriers in target countries

		AT	BG	CZ	DE	FI	FR	IT	RO	ES
Genuine uncertainty	Conflicting information, mistrust of information									
	Heterogeneous outcomes									
	Uncertainty in measurement & verification									
Financial barriers	High initial costs					*				
	Long payback time									
	Access to/cost of capital					*				
	Unwillingness to incur debt									
	Occupant take-back									
	Low/uncertain resale value of property					*				
Organizational problems	Landlord-tenant dilemma									
	Collective decision problems									
	Short timeframe of decisions					*				
	Public budgeting practices									
Lack of information & skills	Lack of customer attention and interest					*				
	Lack of customer knowledge					*				
	Lack of reliable advice					*				
Transaction costs	Lack of skilled service providers					*				
	High information search costs					*				
	Switching costs, concerns over disruption									
	Risks of failures in renovation									

Source: Own compilation, see previous chapters

*= small municipalities

As concerns decision criteria, almost all building owners in Europe, barring some of the more stable professional building owners, give a **priority in their decisions to initial cost**. This is due to several reasons. Unsophisticated financial analysis is one issue, but this is not only the building owners' fault, and cannot be dispelled merely with better information. It is also due to genuine uncertainties about any other financial indicators, about which there generally are no guarantees.

The importance of initial costs is also due to the surrounding institutions, such as the lack of well-suited financial services. For example, a large share of European households are unable to finance energy renovations with their savings and need credit for their energy investments. While savings rates are high in many countries, these are used for investments in property (e.g. acquisition of homes and payment of mortgages), and in many countries few households have surplus savings for investments in energy renovations. Among the target countries examined here, only Austrian, German, French and Italian households, on average, actually have money in the bank or other financial securities that could be used for renovations. In other countries, on average, households must turn to a bank for a loan (Eurostat 2009). Banks are not eager to offer finance, or interest rates are high in several countries and for several types of investors. In general, because of the persistent uncertainty surrounding Europe (and even more, certain countries and regions), implicit discount rates are high. Within this aggregate uncertain context, there are large groups of people and renovation projects that are not at all bankable. Moreover, financial institutions cannot identify (at reasonable cost) which projects are bankable and which are not, so they can refuse even sound applications.

Improved comfort and **energy costs savings** are major drivers for renovation in several countries. Apart from some exceptional situations, however, merely energy cost savings are usually not sufficient drivers to launch a major renovation. Improved comfort and better living or working conditions were often the most important criterion, and in some countries, also aesthetic aspects. The inclusion of energy aspects into planned (“necessary” or desirable) renovations seems to depend greatly on government support programmes, such as **grants, tax deductions and low-interest loans**. These seem to make a difference in both countries that are struggling financially and in countries where building owners are financially stable. In particular, they seem to influence the **type and scope of energy improvements** included in the renovations.

Timing vis-à-vis previous renovations is a factor that is really important in some countries and for some kinds of building owners and almost irrelevant for others. This appears to depend on the renovation history of the buildings and on the historical existence of more-or-less standard renovation schedules. In countries where there has been virtually no renovation for decades, the previous renovation does not make a difference. However, the technical need to make a renovation is a key driver of renovation in all countries (even though this “need” is perhaps measured somewhat differently). There are, however, also other occasions for renovation, such as the change of ownership of a property (especially single-family homes). For most kinds of more comprehensive energy renovations, linking this to either an otherwise “necessary” renovation or to a change of ownership is almost a prerequisite. Timing is hence of utmost importance.

This said, there are differences among single-family homes and (most) apartment buildings in how renovations are usually done. Several country studies revealed that renovation is often a continual **step-by-step process in single-family homes**. Owners save up money and renovate one or two building components every few years – the boundary between maintenance and renovation is thus not sharply defined. This is often connected to a more-or-less do-it-yourself mode of renovation, which is common in most rural areas and also in more urban ones in some countries. This does not mean that owners perform all of the work themselves, but they can also contract builders or installers for part of the work. However, architects or engineers are rarely involved, unless their signature is needed for a permit. Some of our interviewees were very critical of this kind of piecemeal renovation, but others believed it to be an unavoidable fact of life. One of the experts we interviewed was even developing a model for how a passive house standard can be reached over several years through consecutive DIY steps and another called for “do it yourself – technologies” for energy refurbishments.

The situation in most apartment buildings is very different. Renovation of the building is an exception in the daily or annual routines (Mjörnell et al. 2010). It is a rare occurrence, which in most owner-occupied apartment buildings in Europe involves a great deal of anxiety, debates and concerns – very often, among owners with widely divergent interests, including owner-occupants, absentee owners of one rented apartment, young families and elderly pensioners. Organizational problems are key, and these have several facets (psychological, social, economic, legal and practical), which also have a bearing on the financial barriers (e.g., need for individual apartments to be mortgaged in order to access a loan in several countries), and also intensifying the transaction costs, such as concerns over disruption and risks of failure.

The role of **widely used solutions** also varies among countries, and here the differences may also relate to interpretation of what this criterion means. The availability of solutions that are relatively standard was seen in many countries to reduce both perceived and real risks, such as search costs and the risks of failure. Moreover, in some countries, the existence of standard models for e.g. renovating panel buildings was mentioned as a major facilitator of renovations. In addition, the literature and many of our interviewees highlighted the important role of real-life examples and peer-to-peer learning in the diffusion of energy efficient solutions. Even though the evidence is inconclusive, this criterion might be particularly important for owner-occupied multifamily buildings, where concerns about making the right decisions are relatively high due to the collective nature of decision making.

13.3 Policy implications

In the light of our review of building owners' decision making and their barriers to energy renovations, there is still a long way to go before deep and comprehensive energy renovations become widespread throughout Europe. Awareness and motivation are not sufficient to promote renovations, because the barriers are more structural and deep-seated.

Energy improvements are today mandatory in several countries when major renovations are made, and they are mandatory under other conditions in certain countries. Even in these cases, however, engagement of the owner-occupants is necessary. Our cases show that owners can block or severely postpone even technically necessary renovations. Moreover, when renovations are finally made, the owners have a large impact on what energy efficiency improvements are included and how well they are implemented. Further legislation, but also new ways of engaging residents are likely to be necessary to speed up the pace and improve the energy performance of renovations.

A combination of well designed, locally available advice schemes and the establishment of local and regional networks of qualified service providers have had a positive effect on renovations. Combinations of public advice and public-private finance have also shown good results. It seems that face-to-face advice and training are indeed a necessary condition for widespread and well-performed renovations, but not a sufficient one.

The role of initial costs is dominant in most countries among housing owner-occupiers (and several other groups as well). In some cases and to a certain part, this is due to the limited level of sophistication with which costs are assessed. However, this is not only on the part of homeowners. Even in financially stable countries, there are problems in financial services, such as the relatively short loan periods offered by banks for owner-occupied apartment buildings. If the payback period of major renovations is more than 20 years, but loans need to be repaid in 5-10 years, annual costs are bound to rise when the building undertakes a major renovation. This makes the decision inconvenient and painful for owners.

Our literature review and interviews emphasized the role of grants in encouraging investments. The level of grants offered to home owners varies among countries from 15-80% of the total investment cost. Often, however, insufficient funds are budgeted and grant schemes run out of money. Most countries have several schemes, and often at least private consumers struggle to find out about the available options. Even worse, in many countries, grant schemes change every year or every few years depending on state finances and other considerations, leading to confusion and at worst, aborting renovation plans that were already started. In some countries, payment of grants may also be badly delayed. Some interviewees were also critical of indiscriminate state support to renovations without particular energy standards or monitoring of savings achieved. One may also ask whether grant schemes that change annually lead to market failures and increase the price of renovations, as the supply of renovation services never has time to adapt to demand. The situation is not expected to improve as most European countries are currently struggling with budget deficits.

However, grant schemes that are combined with advisory services, technical support and supplier certification have shown particularly good results. Moreover, grant schemes that require a combination of measures have at least in some countries led to more comprehensive renovations. One might hence conclude that grant schemes can be part of the solution, but need to be adequately budgeted over several years, well planned and delivered consistently. Many of our interviewees also stressed the importance of other financial instruments, such as tax incentives, soft loans, ESCOs and energy savings obligation schemes for energy providers. Energy savings obligation schemes are to become mandatory in Europe as a result of the Energy Efficiency Directive, and offer one way to finance investments when other sources of capital are scarce.

Policy measures should also be targeted to “windows of opportunity” for energy renovations. The change of ownership of (single-family) buildings is one such opportunity, which is to some extent already addressed by the energy performance certificates system. Elderly people (often seen as a problematic group) also have a need to renovate their homes for old age: this is another window of opportunity. In multifamily buildings and service buildings, such “windows of opportunity” may be more difficult to find. However, the opportunity to combine energy savings with other benefits is a major driver for renovations in all kinds of buildings and this should be better addressed in communications, and if possible, also in other kinds of support schemes and incentives.

The quality of renovations and the competence of the workforce were identified as a widespread problem almost throughout Europe, though its severity varies by country. Measures are underway in several countries and throughout Europe to build up competencies via training and certification. This is very necessary. However, if energy renovation rates are to be multiplied quickly, the problem of lacking workforce is likely to spread throughout Europe: if countries with currently low renovation rates are to recall their workforce, this is likely to lead to a lack of qualified workforce in the countries where there is a constant demand for renovations. Hence, while our study suggested that renovations among several owner groups can be facilitated via the provision of turnkey solutions and full-service packages, there may be a long way to go before these are widely available.

The findings of our study also raise the question of whether a focus merely on “deep and comprehensive” energy renovations, as they are usually understood, can be spread throughout Europe to all kinds of building owners. Usually, the idea is a well-designed renovation made all at once, with the help of professionals and preferably offered as a turnkey solution. Our observations concerning single-family homes suggest the need for other renovation concepts alongside the comprehensive ‘total’ renovation planned on-site by an architect, because of the tradition of many single-family homeowners (especially in rural areas and less wealthy countries) of making step-by-step renovations. Perhaps there is also a need for more step-by-step energy renovation models, at least for single-family homes. In the best case, these could be targeted at reaching a near-zero energy level over the course of several years.

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Expert interviews

1. Pasi Tainio, Finnish Environment Institute, Finland, Sept 3 2012
2. Petri Pylsy, Kiinteistöliitto (Finnish Real Estate Federation), Sept 10, 2012
3. Erkki Aalto, Rakli (Property and Construction Industry), Finland, Sept 17, 2012
4. Louis-Gaëtan Giraudet, CIREN (International research center on environment and development), France, Sept 26, 2012
5. Jaroslav Suchánek, real estate agent, Czech Republic, Sept 26, 2012
6. Martin Tesař, Economist, apartment owner, Czech Republic, Sept 26, 2012
7. Alena Kliková, Lawyer, owner of a single family house, Czech Republic, Oct 12, 2012
8. Renata Uramová, Head of Department of Property, Housing and Investments of Municipality Prague 13, Czech Republic, Oct 16, 2012
9. Horia Petran, URBA-INCERC, Romania, Oct. 26, 2012
10. Régine Trotignon, ADEME (French Environment and Energy Management Agency), France, Oct 30, 2012
11. Mark Velody, Consultant for Tractabel and international organizations, Romania, Nov 1, 2012
12. Dr. Immanuel Stiess, ISOE (Institut für Sozial-ökologische Forschung), Germany, Nov 1st, 2012
13. Dr. Martin Pehnt, ifeu (Institut für Energie- und Umweltforschung Heidelberg GmbH), Germany, Nov 2nd, 2012

14. Prof. Dr. Harald Rohrer, Linköping University, Sweden (previously Graz University of Technology, Austria), Austria, Nov. 6th 2012.
15. DI. Armin Knotzer, Institut für Nachhaltige Technologien, Gleisdorf, Austria, Nov 7th 2012.
16. Martin Steinestel, Verbraucherzentrale Nordrhein-Westfalen, Germany, Nov 12th, 2012.
17. George Georgiev, Bulgarian Housing Association, Bulgaria, Nov 9, 2012
18. Julien Allix and Sylvaine Le Garrec, UNARC (Association of co-ownership responsible persons), France, Nov 11, 2012
19. Zdravko Genchev, Center for Energy Efficiency Eneffect, Bulgaria, Nov 11, 2012
20. Stevan Borcamp, Romanian Green Building Council, Romania, Nov 13, 2012
21. Xavier Carbonell, ARC Mediacion Ambiental, Nov 13, 2012
22. Dr. Michael Ornetzeder, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, Nov 15th, 2012.
23. Paavo Kykkänen, Kotialue Oy (House Managing Agency), Nov 21, 2012
24. Carlos de Astorza, Spanish Association of Public Housing and Land Developers (AVS), Spain, Nov 22, 2012
25. Sergio Marta, Olano y Mendo Architects, Spain, Nov 22, 2012
26. Gianluca Ruggieri, Politecnico di Milano, Italy, Nov 22, 2012
27. Bettina Schaefer, Ecoinstitut Barcelona, Spain, Nov 23, 2012
28. Liyana Adjarova, Association of Bulgarian Energy Agencies, Bulgaria, Nov 28, 2012
29. Alain Lusardi, Federabitazione Europe – Confcooperative, Italy, Nov 30, 2012