Eindhoven, August 28, 2011

Supporting tenants' decisions on energy-saving measures

How housing corporations can propose work

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identity number 476664

in partial fulfilment of the requirements for the degree of
Master of Science in Innovation Sciences

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Preface

This report describes the master thesis research that I have been working on during the last year of my study in Innovation Sciences at the Eindhoven University of Technology (TU/e). The research is conducted at two Eindhoven-based housing corporations, Stichting Woonmaatschappij Domein and Woonbedrijf SWS.Hhvl. It contributes to the effort of the Kenniscluster EnergieNeutraal Wonen in Brainport (KENWIB) to generate knowledge about zero-energy housing and the trajectories towards it.

The fulfillment of my research would not have been possible without the support, advice and cooperation of others. I'm grateful for that and wish to thank anyone that offered such help. Some special thanks are in place.

First of all, I wish to thank Martijn Willemsen and Geert Verbong for their supervision of my graduation research. Special thanks go to Martijn for motivating and encouraging me time and again with his never failing optimism. Our frequent discussions were very inspiring to me.

I was happy to find a warm welcome at Domein, where I spent most of the time working on my research. I appreciate the openness of my colleagues there and the interest they showed in me. I want to specifically thank Ria Appelo, my supervisor at Domein, and Robert Arts, who filled in for her during the last stage of my research project.

At Woonbedrijf I want to thank everyone that helped me with my research, with special thought to Linda Tuijt, Rob Bogaarts and Ward de Kinderen.

To my friends and family I am grateful for encouraging and supporting me. Some of them earn extra credits for bearing with me during the stressful periods: thank you Joyce, thank you Jacqueline, and thank you Michiel.

Throughout the last year I have always found that I had a really interesting research subject.
I hope you will enjoy reading about it.

Rianne Wolters

1 Introduction

Energy-saving measures in rental houses contribute to the solution of climate problems as well as (anticipated) problems with living expenses. Reduction of energy consumption and CO_2 emissions is widely viewed as a necessity to overcome the greenhouse effect. Government policy is set out on European level, as well as national and regional levels. For example, the municipality of Eindhoven has the ambition to become energy-neutral by 2035-2045. Energy improvement is ongoing in new housing developments, but this comprises an insufficient amount of houses to reach the envisioned goals. Therefore, interventions in the existing housing stock are necessary.
Energy costs are rising due to the exhaustibility of fossil fuels and the dependence on politically unstable regions. These rising energy costs threaten to cause problems with living expenses for tenants. Living expenses are the combined expenses for rent and energy. Rapidly increasing energy bills are particularly problematic for low-income households. Their energy consumption is already lower than that of higher-income households, so they cannot save as much (Nibud, 2009). Furthermore, they often live in houses with low energy performance. Energy-saving measures can prevent living expenses from rising dramatically in the future. This holds even when the energy measures include a rent increase, because energy prices rise much faster than rents.
Housing corporations are in a good position to make a contribution in solving these problems. They own a large amount of the existing housing stock and their target group consists of low-income households. The government also expects them to fulfill such a social role.
Taking energy-saving measures involves substantial investment costs that can (partly) be passed on to the tenants by means of a rent increase. However, tenants have to give their consent for that. Housing corporations could increase the rent price more easily if they make the improvements on a change of tenant. However, this is not very attractive. The rate of tenant turnover is too low to achieve substantial improvements over a reasonable time period. Also, the costs per dwelling are higher than in a project for a block of houses. In some cases, especially for apartment buildings, it is not even possible to perform the work on individual dwellings.
Thus, housing corporations need to propose rent-increasing energy-saving measures to sitting tenants. When deciding whether to accept, tenants have to trade off the benefits of reduced energy costs and increased comfort of living against the costs of the rent increase and the temporary discomfort during renovations. Housing corporations experience that tenants are reluctant to give their consent, even when the benefits outweigh the costs (Aedes, 2010).
This reluctance of tenants to participate in energy-saving projects even when the offer is beneficial to them indicates suboptimal choice behavior. Decision-making research aims at explaining such suboptimal choices. The present research investigates which explanations may hold for the suboptimal choice of (some) tenants.

The aim of this research is to investigate what factors influence the decisions of tenants to accept or reject rent-increasing energy-saving measures, and to recommend how this knowledge can be used to help tenants make more well-informed decisions.

This aim can be broken down into the following research questions:
What factors influence the decisions of tenants to accept or reject rent-increasing energy-saving measures?
How can tenants be helped to make well-informed decisions?
Do the recommendations to help tenants make well-informed decisions work in practice?

This research addresses both a practical societal problem and a scientifically relevant decision-making issue. A translation is made from theory to practice by proposing an intervention to help people make well-informed decisions.

The following steps are taken to answer the abovementioned questions. After a broad outline of the socio-technical background of the research problem in the next chapter, an overview of relevant decision-making theory is provided in chapter three. To complement the results from literature research, information from practice is gathered through interviews with tenants and a review of current brochures. Those are elaborated in chapter four. Several recommendations are given, comprising the enhanced, more prominent presentation of the advantages of the energy-saving measures, the individualization of the expected energy saving, and a focus-broadening elaboration of some specific advantages. The recommendations are actualized in informational brochures, inserts and a webpage and tested in an experiment. Chapter five presents the hypotheses that are tested in the experiment. The experiment is described in chapter six, as well as the accompanying questionnaire which provides additional information regarding possible mediating variables. In chapter seven, the results are discussed. Conclusions and recommendations are given in the last chapter.

The research is conducted in Eindhoven at two housing corporations, Domein and Woonbedrijf. Although the outcome of this research is of interest for those corporations, the focus is broader and results apply to tenants of other corporations too.

2 Energy-saving measures in rental homes: socio-technical background

Improvement of the energy performance of rental homes can be achieved with several different technologies. These vary from passive measures like cavity wall insulation to active systems like solar boilers and heat pumps. Housing corporations are taking steps to apply such measures. Other actors are involved as well. Tenants play an important role because they need to consent to the work on their home and the associated rent increase.

Below, the socio-technical background of the research problem is described in three dimensions; technologies, actors, and policy. The available technologies are described and the most commonly used are pointed out. The roles of different actors involved are discussed, as well as policy and legislation that apply to the case.

Part of the information provided in this chapter is gathered through personal communication with experts, such as employees of housing corporations and consultants. The experts interviewed in this research are listed at the end of the references section (p. 58).

2.1 Technologies

There are several technologies that improve the energy performance of dwellings. Newly built houses already have some of them implemented due to legal requirements. Older, existing homes did not have these requirements and therefore have no or less energy-saving properties. Thus, energy-saving measures have to be retrofitted.

For some energy-saving technologies this is hard or impossible to do. Therefore, fewer energy-saving measures are available for existing houses than for new housing development. Below, only the options for existing housing are discussed.

CO_2 emissions can be reduced in three distinct ways: by reducing the energy demand, by using renewable energy sources for the remaining energy demand and by improving energy efficiency where fossil fuels still need to be used.

Some energy-saving measures require installations to be added to a dwelling. These are called active measures. Passive measures are adaptations to the building envelope. These generally reduce the energy demand, because less energy is required for heating the dwelling. The active measures either provide renewable energy or improve energy efficiency.

Passive measures

Available passive measures are retrofitted insulation, low emissivity glazing and improved airtightness. Retrofitted insulation can be applied to floors, façades, and roofs. Since heat tends to rise, roof insulation is more efficient than floor insulation.

Retrofitted floor insulation is often more difficult to apply than other retrofitted insulation. Depending on the availability of crawl space below the ground floor, insulation can be attached below the existing floor, or the floor needs to be removed and replaced by an insulated floor.

Retrofitted façade insulation is often applied in cavity walls. These walls consist of two walls, or skins, at a small distance from each other. The inner skin is a supporting wall, the outer prevents rain and moisture to enter and pass to the interior of the house. To insulate the wall, several holes are bored into the outer slab from the outside. Through these holes the insulating material is blown into the wall cavity. The insulating material can be a fibrous or granular material or foam. The maximum achievable amount of insulation is determined by the width between the cavity wall slabs and the thermal resistivity of the chosen material.

To insulate the wall as best as possible, thermal bridges should be avoided. Thermal bridges are parts of the façade where heat can flow from inside to outside more easily than elsewhere. This for

example occurs when a (metal) window frame out of one piece is in contact with inside and outside air. This is why windows need to be well insulated as well.
Not all houses have cavity walls. Single-skinned walls can be insulated from the inside as well as from the outside. On either side, the insulating material needs to be finished with plaster or some other material. Since it is often wished to preserve the appearance of these houses, which are generally quite old, insulation from the inside is more common.
Roofs are often retrofitted from the inside too. Insulating blankets or panels are attached to the supporting structure. These can for example be finished with plasterboard. If the attic is not used as a room, the insulation can be put on top of the attic floor instead of under the roof.
Windows can be equipped with low emissivity (or low-e) glass. This is double glazing with a coating that reflects infrared, but lets visible light pass. It is also filled with a special gas. New glazing can be placed into existing window frames. When the frames are old, when they form thermal bridges or when their connection to the wall is not airtight, they are replaced to improve the insulation of the façade.
Air tightness can also be improved by placing weather strips in doors and window frames. This prevents draught. Besides the reduction of energy needed to heat the cold air coming in, this improves living comfort.

Ventilation

When applying the abovementioned measures, it is important to take care of sufficient ventilation. Otherwise, the improved insulation and air tightness can lead to problems with moisture and bad air quality. Before renovation, most houses only have natural ventilation. After renovation, this type of ventilation will not be sufficient to assure a good indoor air quality. Therefore, some type of mechanical ventilation system has to be installed.
Balanced ventilation systems with heat recovery are usually not applied in a renovation project due to the limited amount of space available in existing houses. Systems with mechanical extraction of air and natural supply through grills in the façade are commonly applied. These systems assure that a sufficient amount of fresh air enters the house, which results in a good indoor air quality en healthy living conditions. The downside of this system is that during winter time cold outside air is directly drawn into the house. Besides complaints of draught and cold this could increase the amount of energy required for heating the air.
To reduce this problem, CO_2 level controlled ventilation can be applied. This system only switches on the air extraction when CO_2 levels inside the house are too high. This reduces energy demand for heating, because no air is extracted and consequently no cold air enters the house when there is no one is present. Also, the amount of electricity used by the extraction unit is decreased, because it runs less often.
Another way to reduce the energy loss of heating cold fresh air is a system with heat recovery. Heat is recovered from the extracted air and transferred to water. The grills in the façade are fitted with a fine mace of tubes through which the heated water runs. This way, the incoming air from outside is preheated and energy for heating is saved. A further advantage is that preheated air increases living comfort, since there is no cold air coming in.

Active measures

Active measures to reduce energy use for houses can be divided into electricity and heat production. Options for local production of electricity are photovoltaic cells, and small urban wind turbines. Options for heating are solar boilers and seasonal thermal energy storage. When using the more traditional gas-fired central heating systems, a high efficiency type can be installed. Micro-CHP systems combine the production of heat and electricity.

Photovoltaic cells (PV cells) are semiconductors that convert radiation energy from the sun into electricity. Different types of cells are available on the market. Most commonly used for residential buildings are crystalline cells mounted in panels on a slope on the roof top. For these cells it is very important that they catch as much direct sunlight as possible. Therefore, the orientation of the roof is very important. Amorphous cells do not have this disadvantage. For this type of cells, direct sunlight is not as important as for the crystalline cells. Also, they can be produced in such a way that they are flexible. Therefore, they can be well applied on flat roofs, where they are incorporated in the roofing material.
PV cells are not commonly applied in renovation projects of housing corporations. This is mainly due to their costs. At the moment, PV cells are still relatively expensive with a low return on investment. It is expected that this will change in the future due to rising energy prices and a decreasing price of PV cells.
Another way to generate renewable electricity is by making use of wind energy. Small wind turbines are available that are specially made for the urban environment. They come in different shapes and designs, but they all need to be mounted on the roof of house. On existing houses this means that some kind of additional constructional measures have to be taken. This can be an obstacle for their implementation, especially on terraced houses. Also, two- or three-story houses are relatively low, which decreases the efficiency of the wind turbine. On a multi-family building, the installation will be easier. Wind turbines are not commonly applied in renovations for the same reasons that apply to PV cells. They are still relatively expensive and the return on investment is low.
Solar boilers are a technological option for producing heat. A solar boiler is a system that consists of a solar collector which collects thermal energy from the sun. The sun heats water in the solar collector. Usually these systems are used to heat tap water. Tap water requires a temperature of at least 60˚C in order to reduce the risks of legionella infections. During summer the water in a solar collector can reach these temperatures, during the winter the water needs to be further heated by an additional source, either gas or electricity. Applying a solar boiler can substantially decrease the amount of energy used for the heating of tap water.
Applying a solar boiler during a renovation is only viable when the house is also equipped with a new central heating system during renovation. Solar boilers are not often applied (yet) in renovations.

Seasonal thermal energy storage is another option for producing heat during winter. During summer it is used to cool. Thermal energy can be stored in several ways. In the Netherlands, aquifer thermal energy storage is applied most. Energy is stored in two aquifers (wells) at approximately 100 meter under the ground. Heat can be stored here for a relatively long time while temperature fluctuations are low due to the depths of the wells.
One well is the cold storage and the other the warm storage. During winter heat is extracted from the warm well; the cold that is extracted from a building is transferred to the cold well. The temperature of the water in the warm well is not high enough for heating a home. Therefore, a heat pump is required to increase the temperature to 35 to 40 °C that a building can be heated with.
During summer the cold from the cold well is extracted to cool the building; the heat that is extracted from the building is transferred to the warm well. This heat is used again the next winter. The temperature of the cold well is not always low enough to cool a building. In that case the heat pump could be used as a refrigerator (cooling machine) to reduce the temperature of the water.

In this way a lot of energy can be saved, especially when cooling is required. Aquifer thermal energy storage is applied in domestic areas, but is more often used in utility buildings. It is mostly applied when a building is newly built. When this system is applied to a renovation project the connected homes need to be equipped with a low temperature heating system, such as floor heating. Besides, all dwellings need to be cooled during summer as well because an equal amount of heat needs to be extracted and put back into the wells on a 5 year basis. It is possible to take additional measures to keep the energy balance in the wells, but these measures reduce the energy efficiency and the cost effectiveness dramatically.

A micro combined heat and power (micro-CHP) system generates both heat and electricity. It is a gas-fired central heating system complemented by an engine that produces electricity. The engine can be of different types. At the moment, tests are running with micro-CHP systems equipped with a sterling engine. Since this technology is still in development, it is not often applied in renovation projects, nor is this expected to happen in the near future.
High efficiency gas-fired central heating systems make use of the heat that becomes available when exhaust gasses are condensed. This makes these systems much more efficient than older central heating systems. In newly built houses with a gas connection, high efficiency central heating is very common. Older houses sometimes are still equipped with old-fashioned and inefficient central heating systems, or with independent (gas) heaters. Replacing these systems with high efficiency ones is a very cost effective measure and is often applied during renovation.

2.2 Actors

The implementation of energy-saving technologies in the existing housing stock is influenced by many actors. This section introduces the main actors involved and their relationships. Also, the common conduct of proposing and implementing energy-saving measures is briefly discussed.

Actor network

Figure 2.1 shows the network of relevant actors. Central in the figure are the housing corporation and the tenants. The works proposed by the corporation and the decision to be made about that by the tenants are central in this research. The actors in blue are involved in the realization of the energy-saving projects. The actors in green are interest groups of the tenants and the corporations. In orange, government institutions are depicted.

The central actors involved in the improvement of energy efficiency of rental houses are the renters and the tenants. A renter can be a private person or private enterprise, or a social housing corporation. This research focuses mainly on the housing corporations.
There are five housing corporations in Eindhoven: Woonbedrijf, Domein, Trudo, Wooninc, and Vitalis. They also own houses in several neighboring towns. In the past, housing corporations used to be public services owned by municipalities. Their task was to provide social housing for low-income households. During the 1990's they were privatized. However, social housing is still regulated for dwellings with a rent below the liberalization limit.

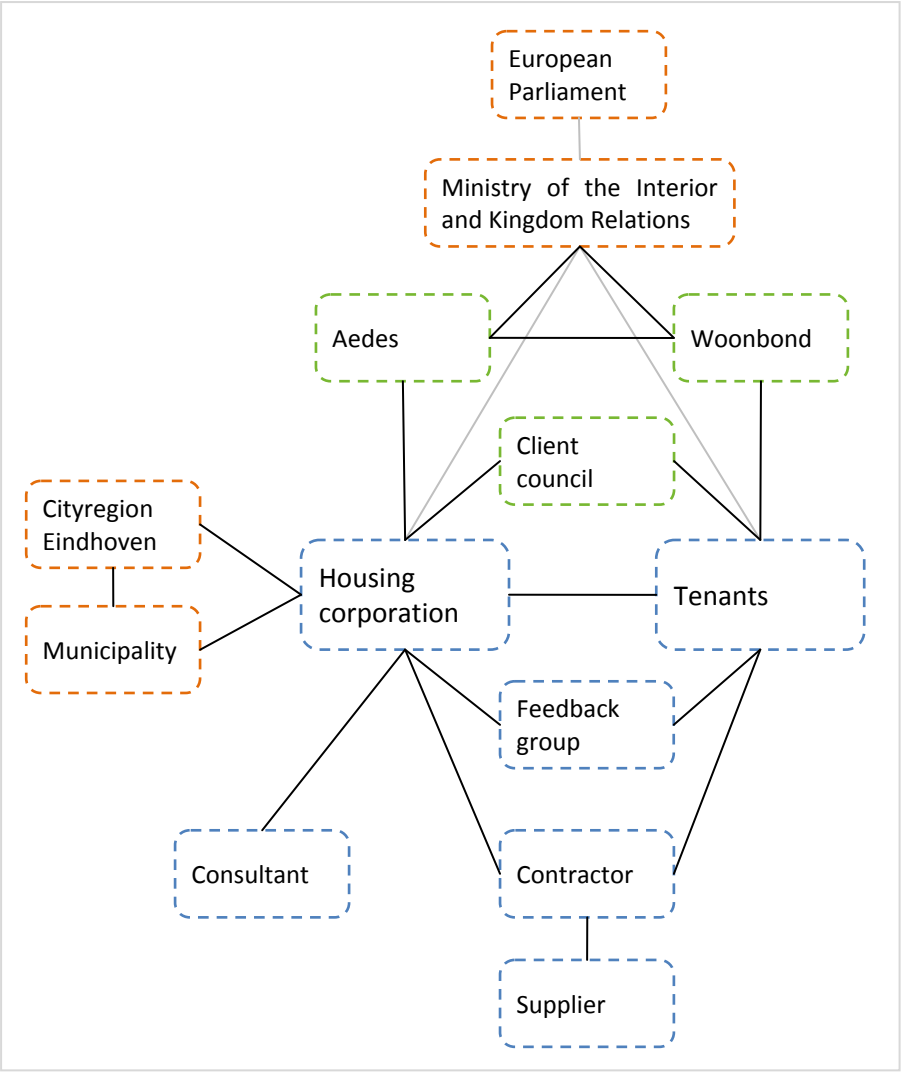


Figure 2.1 – Actor network

The housing corporations plan and propose the energy-saving measures that are to be taken. Tenants need to accept the proposal of the corporation before the work can be carried out. The response of tenants to the proposed energy measures varies from one project to another. In some projects, tenants are reluctant to give their consent, even when they are expected to financially benefit from it.

Both the housing corporations and the tenants have a national interest group: Aedes and Woonbond respectively. Both deem improvement of the energy efficiency of houses important and communicate and cooperate on the subject. They proposed the "Woonlastenwaarborg", a guarantee given by a housing corporation that living costs will not rise due to the energy-saving measures. (Aedes & Nederlandse Woonbond, 2009)

Tenants are also represented in smaller interest groups such as client councils representing the clients of one corporation and feedback groups that are especially formed at the start of a renovation project to represent the tenants in the area concerned.

During the preparation of the work, consulting agencies are often involved. They advise the housing corporation about the energy-saving measures to be taken with regard to the financial investments and expected improvement.

Some housing corporations have maintenance departments that can carry out the works. More often, the energy-saving measures are put out to construction and/or installation companies.

Energy companies have an interest at stake in the energetic improvement of dwellings, for energy-saving measures reduce energy consumption. The energy-saving measures have a negative effect for them, since the demand for their product is decreased. However, they do not have the means to prevent corporations from planning energy improvements. Therefore, they do not play a large role in the decision to take such measures. Still, they have valuable information for anyone who wants to calculate or measure the effect of energy-saving measures: household energy usages.
Since there is a call for reduction of CO_2 emissions, at least in policy, some energy companies start looking for other business opportunities. For example, they can lease installations for local renewable energy production to house owners and/or corporations. Thus, their role will probably change over the course of time.
Governments at European, national, regional, and local levels have set out policies to reduce energy use and CO_2 emissions. Some policies are more specific than others and therefore affect the decision under study more directly. They are discussed below in section 2.3.
The municipalities of Eindhoven, Helmond and 19 surrounding villages cooperate in the city region Eindhoven (SRE).
On the national level, the Ministry of the Interior and Kingdom Relations regulates the housing market. They prescribe maximum rents for public housing and lay down the rights of tenants and renters. Applicable to the current case are laws regarding rent prices and rent increases, and maintenance and other work on rented homes. These are also discussed in section 2.3.

Common conduct of energy-saving measures in social housing

Housing corporations are the initiator of a project with energy-saving measures. These are often, but not necessarily, combined with planned maintenance work. An ambition is set for the improvement of the energy performance within a certain budget. This ambition may be derived from the corporation's policy. The approval of such policy by the client council of the corporation can be helpful in guiding and explaining decisions regarding a specific project.
Tenants are informed about the forthcoming work, and are often asked to join a feedback group. The plans are discussed and sometimes negotiated with this group. The plans are then communicated to all tenants in the project by brochure and/or letter. They are usually invited to attend an information meeting, where the details of the work are presented as well as a time schedule. The current state of each dwelling is inspected by an employee of the housing corporation. The work may need to be adapted to the specific situation. During his visit, the employee can further explain the details and answer any questions if needed. Often, tenants can visit a show house. Any new materials, from bathroom tiles to a ventilation unit, can be shown there. This helps people in forming an image of the results of the work.
The work is usually carried out by a contractor. During the work, tenants can address their questions and complaints to a supervisor appointed by the contractor or by the housing corporation. When the works take long, e.g. in a large district, or when unexpected problems are encountered, some extra communication (by letter) may be needed.
After completion, the work is inspected by the supervisor of the housing corporation. When the project is finished, tenants are sometimes sent a delivery brochure with instructions for usage and maintenance.

2.3 Policy and legislation

The housing sector has to comply to several laws and legislation. Some address energy performance, many others do not. Only the laws and articles that are relevant for this research are discussed here. Relevant policies and legislation fall into two categories, energy policy and rent legislation. They are discussed in turn below.

Energy policy

Several governmental policies guide towards improved energy performance of buildings. They result in regulations as well as covenants and performance agreements. There are also subsidies on certain energy-saving technologies.

Energy reduction ambitions apply to our society as a whole, not to the housing sector alone. They are laid down in legislation and policy documents at international, European, national, and local level. Some regard energy and/or CO_2 emission reduction in general. Other policy is specifically aimed at saving energy in the housing sector. These are elaborated below.

The industrialized countries agreed to jointly reduce greenhouse gas emissions in 1992 through the United Nations framework convention on climate change (UNFCCC). In the Kyoto protocol of 1997, figures were put to these intentions. The developed countries were to reduce their total emissions to at least 5% below 1990 levels by 2012. Not all industrialized countries ratified the protocol (e.g. the United States and Australia). The European Community did sign the protocol, which went into force in 2005. (Europa.eu, 2010)

In 2002, as a contribution to fulfill the commitments of the Kyoto protocol as well as the security of energy supply, requirements for the energy performance of buildings were laid down in Directive 2002/91/EC. It regards both the residential sector and the commercial and industrial building sector. It requires of Member States to implement a common methodology to calculate the energy performance of buildings and to set minimum standards for performance. It also demands certification of the energy performance of new and existing buildings. (Europa.eu, 2007)

In the Netherlands, this resulted in energy performance certificates (EPCs) for new buildings and energy labels for existing buildings. The energy performance of buildings directive is laid down in Dutch law through the Besluit Energiebesparing gebouwen and the Regeling Energiebesparing gebouwen in 2006.

In 2010, a recast of the Directive 2002/91/EC is adopted, which has consequences for the existing housing stock. The old Directive already demanded minimum performance standards after major renovation, but only for buildings larger than 1000 m^2. This threshold is dropped in the new Directive 2010/31/EU. The requirements of this Directive must be met by the Member States before July 9, 2012. (Europa.eu, 2009)

In January 2008, the Dutch government and several market parties signed a covenant for energy reduction in existing buildings, called Meer met Minder (More with Less). It presents the aim to save 100 PJ in existing buildings by 2020. To achieve that, the improvement to energy label B of 500.000 existing houses and other buildings is envisioned. In the same year also the Lente-akkoord was signed which regards new housing development.

In connection with both abovementioned covenants, a new covenant is signed in October 2008 that addresses the social housing sector specifically. It postulates the ambition to reduce the energy use of existing social housing with 24 PJ by 2020. Aedes and Woonbond, signers of the covenant, propose the Woonlastenwaarborg to be used to achieve this.

Rent legislation

Housing corporations and tenants have a contract that allows the tenant to live in a dwelling owned by the corporation on payment of a certain rent. The rent includes costs for regular maintenance that the corporation carries out. Generally, energy costs are not included. The tenant has a separate contract with the energy supplier for that.

Much of the content of the tenancy contract is restricted by law in order to protect tenants from exploitation and fulfill the basic need of housing. But also tenants' duties are described.

To keep housing affordable for low-income households, a maximum rent is allowed. Also, a maximum annual rent increase is set by the national government. The maximum rent depends on the quality of the house and can be calculated using the house value rating system[1]. Value points are assigned for aspects such as surface area of the rooms, central heating, sanitary facilities, dwelling type and services offered. As of July 1 2011, the house value rating system is adapted to include energy labels. The purpose is to stimulate housing corporations to take energy-saving measures. Table 2.1 shows the value points assigned for each energy label. Former value points for some specific energy-saving measures, such as insulation, are dropped. They amounted to a maximum of 15 value points. As a result, energy efficient dwellings are valued much more than before, whereas dwellings with low efficiency may lose points. (Weevers & Go, 2010)

Table 2.1 – Energy label and house value rating points

Energy performance	Single-family dwelling	Multi-family dwelling
Label A++	44	40
Label A+	40	36
Label A	36	32
Label B	32	28
Label C	22	15
Label D	14	11
Label E	8	5
Label F	4	1
Label G	0	0

When a housing corporation improves a dwelling significantly, the maximum reasonable rent according to the house value rating system increases. However, the corporation cannot simply do this and increase the rent for sitting tenants without consultation.

The work first needs to be proposed to the tenant. According to the Netherlands Civil Code[2], article 7.220, the tenant is obliged to allow the execution of the work if the renter makes a reasonable proposal in view of the interests of the renter and of the tenant as well as any subtenants. Furthermore, article 7.255 of the Civil Code stipulates that a rent increase can be demanded for alterations that improve the convenience of living.

If the work includes ten or more dwellings that form a building complex, a proposal is presumed to be reasonable when at least 70 percent of the tenants accept it. Still, the tenants that do not consent have the opportunity to go to court to let the reasonability of the proposal be judged. (Civil Code, art.7.220, clause 3)

In practice, housing corporations prefer to avoid going to court as well as upsetting their tenants. They either try to achieve at least 70 percent acceptance of the tenants and enforce the work on the others, or carry out the work only for those tenants that accept. In both cases it is important to make the tenants a good offer. However, housing corporations frequently encounter reluctance to participate, even if they make a good offer.

[1] In Dutch: woningwaarderingsstelsel (WWS)

[2] In Dutch: Burgerlijk Wetboek (BW)

2.4 Conclusion

The previous section illustrated that policy and instruments to stimulate improvement of the energy performance of houses have developed over the last decennia. Looking back at the actor network in Figure 2.1, it appears that most stakeholders are involved in this. The instruments mainly originate from the governmental actors (in orange). Negotiation takes place between them and the housing corporations at regional level and with the interest groups Aedes and the Woonbond at the national level. Housing corporations, contractors and suppliers are furthermore affected by subsidies.

Tenants however, are less affected. They will be addressed through the provision of energy labels in the advertisements for vacant dwellings. However, this does not affect sitting tenants. In other words, housing corporations seem to be addressed more directly and have a more active role than tenants. This is reflected in the intentions that many corporations show to take energy-saving measures, and the reluctance to participate that they encounter in some tenants.

Therefore, the tenant's decision whether to participate in energy-saving measures or not is an interesting subject to investigate. This individual decision of the tenant is investigated here, and not the influence of other actors, e.g. discussions with relatives and neighbors. The research will result in recommendations for housing corporations on the communication toward their tenants about the proposed energy-saving measures.

Previous research in decision-making theory offers insights for this. The next chapter looks in to that.

3 The tenant's decision: relevant decision-making theory

When deciding whether to accept the rent-increasing energy-saving measures, tenants have to trade off the benefits of reduced energy costs and increased comfort of living against the costs of the rent increase and the temporary discomfort during renovations.

People do not have a ready answer to such decisions. Rather, they construct their preferences during the process of thinking about choice. This process is not always the same as it is influenced by the way a question is put or the context in which a decision is made. This can lead to violation of rationality when different thinking processes lead to different preferences and consequently to different choices, while the available options stay the same.

In this way, people can easily make choices that are not optimal for them. Russo, Carlson & Meloy (2006) demonstrate in their research that people can even be induced to choose an alternative that is inferior to them personally. In the first session of the experiment, respondents' preferences regarding two sets of three restaurants were measured. Based on this information two new sets of two restaurants were created, so that the preferred restaurant was known for each set. In the second session, the attributes of one set of restaurants were presented such that participants were induced to choose the inferior alternative. To achieve this, the advantages of the inferior alternative were presented more prominently; the most advantageous attribute was put first and the advantages of the preferred alternative were listed later. A majority of participants chose the inferior option. The other set of restaurants was not tuned to induce inferior choice. Indeed, a minority of respondents chose the inferior restaurant in this set.

This research shows that people can be lured into choosing an alternative they would not want. However, this also offers the opportunity to set up a decision in such a way that people are more inclined to choose their preferred, optimal solution. Thaler and Sunstein (2009) propose to nudge peoples choices in a certain direction in such a way. They reason that since it cannot be avoided that people are influenced by the way a choice situation is arranged, purposely or not, it is to be favored that such choice situations are designed conscientiously. They propose to "… help people make better choices (as judged by themselves) without forcing certain outcomes upon anyone…" (Thaler, Sunstein & Balz, n.d., p.1).

So, how can this be applied to the decision that a tenant has to make regarding energy-saving measures and a rent increase proposed by their housing corporation?

First of all, this investigation is directed towards situations where the financial outcomes are positive for the tenant. The other outcomes, living comfort and temporary discomfort during renovations, cannot be evaluated objectively and will vary from person to person due to individual preferences. For most tenants however, the temporary discomfort will most likely not outweigh the benefits. The remaining tenants should always have an easy opportunity to opt out. Knowing that Dutch legislation demands that renters first get the consent of their tenants, this is expected to be the norm.

Below, several options suggested by previous research in decision making are described that could be applied to nudge tenants to accept energy-saving measures.

Order of advantages and disadvantages

People tend to focus on information that confirms their current beliefs. This is called confirmation bias. When their first impression of the energy-saving measures is positive, they will more readily take into account new positive information about the energy measures than new negative information.

According to query theory, people break down a decision into sub-questions (Johnson, Keinan & Häubl, 2007). Why should I choose option A? Or, why should I accept the energy-saving

measures? Why should I not choose it? These questions are not processed simultaneously, but one at a time. The order in which the questions are processed influences the outcome of the decision. If someone first thinks about reasons in favor of one option, this person is more likely to choose that option.
In the research described at the beginning of this chapter, Russo et al. (2006) used predecisional distortion of information to increase people's appreciation of a self-appointed inferior alternative. This means that they used people's tendency to fit new information about an option to their current preference. Suppose that the first piece of information favors one option and consequently makes this option tentatively leading. Subsequent information that is not (strongly) in favor of any of the options then contributes to the preference for the leading option. That way, the initial leader is favored more than it rationally should be.
Russo et al. (2006) used this effect to induce preference reversal and make people choose an alternative that was inferior to them. Of course, this is not the intention when trying to improve the tenants' decision about energy-saving measures. The same effect can still be applied to this situation where choosing the superior alternative is intended.

Keeping to the default option / status quo

People are biased in their decisions toward choosing the status quo. This situation is known to them and any alternative brings in uncertainty. Also, if a choice is not mandatory, not choosing will result in maintaining the status quo.
The endowment effect is an illustration of this. People are more eager to keep what they have than that they would be eager to attain it, when they did not have it. For example, compare the following two methods to find out how much a coffee mug is worth for someone. One method is to ask the person how much he would pay for it. The other method is to give him the mug and then ask at what price he would be willing to sell it. Rationally, the prices should be the same. In research it is found that the price that people would pay to buy the mug is lower than the price they would ask to sell it. (Johnson et al., 2007)
Default options are more often chosen than other options. This is for example seen in the difference in numbers for organ donations between countries that have an opt-in and countries that have an opt-out system. Figure 3.1 shows the consent rates for organ donation for eleven European countries, gathered by Johnson & Goldstein (2003). The difference between opt-in and opt-out systems is very clear.
In the case of proposing energy-saving measures to tenants, an opt-out system would be desirable. However, Dutch rent law does not allow for this. A tenant's consent to the work and the rent increase is needed before the work can be carried out. Still, energy measures could be suggested as the default choice.

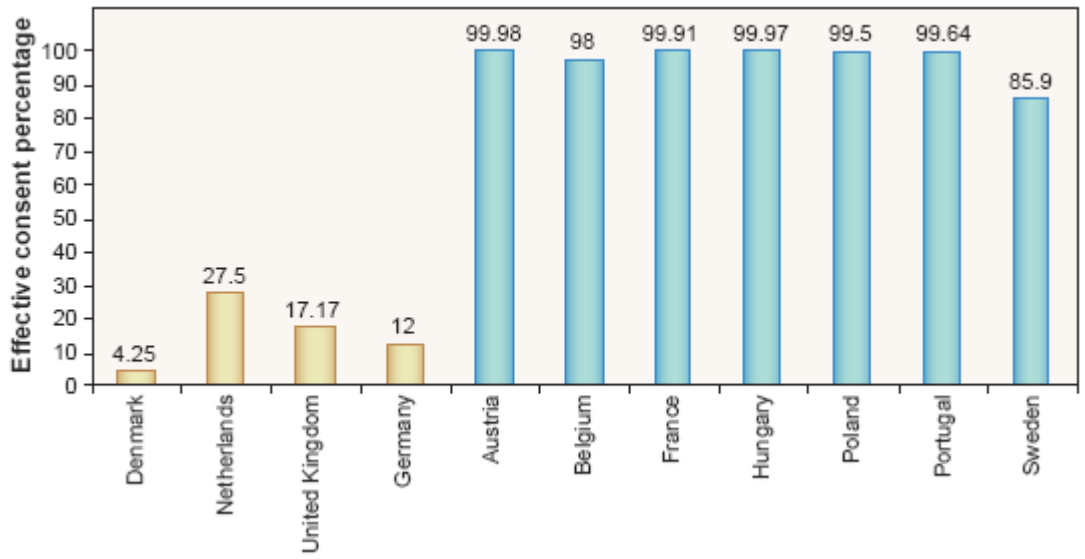


Figure 3.1 - Effective consent rates for organ donation, by country. Explicit consent (opt-in, gold) and presumed consent (opt-out, blue).

Source: Johnson & Goldstein (2003), p. 1338

Thinking about the future

People are myopic and tend to focus on the present. They generally prefer rewards now to rewards in the future. This is called time preference. It is also said that future effects (gains or losses) are discounted. Good reasons exist to discount future effects, e.g. that the future is always uncertain. However, discount rates would be expected to be constant over time and for the same effects. This is not reflected in actual behavior. For example, people are found to have declining discount rates for effects that lay further in the future. Also, discount rates for gains are higher than for losses. (Hardman, 2009)

Tenants considering the rent-increasing energy-saving measures are likely to focus on the direct (financial) gain of the measures. This gain can be quite small. However, over time it grows larger, because energy prices increase more rapidly than rents. So the amount of money saved by the energy measures grows larger and larger than the extra amount of money paid in rent. However, this increasing future gain is likely to be discounted.

Also, its exponential growth is not likely to be evaluated correctly. Many people do not grasp such growth patterns. Frederick (2005) indicates that for those who do grasp it, it is not intuitive and cognitive reflection is needed. An example is provided in one of the three items of the cognitive reflection test that Frederick proposes. The items are found in the text box below. The third item considers exponential growth. The intuitive answer is 24 days, whereas the correct answer is 47.[3]

Considering the above, tenants could be helped in their decision by bringing focus to the future gain and explaining its exponential growth.

[3] The intuitive and the correct answers for the other items respectively are 10 and 5 cents for item 1 and 100 and 5 minutes for item 2.

The cognitive reflection test

1. A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?
2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Source: Frederick (2005), p.27

Thinking about other energy-saving measures

When deciding whether to accept the proposed measures, tenants trade off the rent increase and a reduction in energy costs. These expenses are paid from a certain mental budget. People have separate mental accounts for different types of expenses. This is helpful in controlling one's expenses. But it can also lead to irrational choices.

A well-known example from Kahneman and Tversky (1984) illustrates this. Two groups of subjects are presented with two hypothetical situations and asked what they would do.

In the first situation, the subject goes to a play for which he bought a ticket at the price of €10. As he enters the theatre, he discovers that he has lost the ticket. He is asked whether he would buy another ticket for €10. In this study, only 46 percent of the subjects said they would.

In the second situation, the subject also goes to a play for which the ticket costs €10, but he has not bought a ticket yet. As he enters the theatre, he discovers that he has lost a €10 bill. He is asked whether he would still buy a ticket for €10. Now, 88 percent of the subjects say they would.

The difference in choices of the respondents is attributed to the topical organization of mental accounts. The purchase of two tickets is booked on one mental account, doubling the cost for the play. The loss of a €10 bill is not booked on that account but rather considered a loss in general wealth. The cost for the play remains €10.

The effect of topical mental accounting is reduced when both situations are presented to the same subjects. Their willingness to pay for an extra ticket increased when this situation was presented after the lost-cash situation.

A similar situation might occur in the decision of tenants whether to accept rent-increasing energy-saving measures. By comparing the proposed energy-saving measures with other energy-saving measures, such as buying A-label appliances or reducing the heating temperature with one degree, people are expected to be less averse to the rent increase. This is because the money is no longer taken from the mental rent account, but (also) from a mental account for investments for energy reduction, or from their general wealth.

The comparison of the proposed with other energy-saving measures also changes the decision problem from a separate to a joint evaluation. Decision making research found that preferences can (irrationally) be changed due to a change in evaluation type (Hardman, 2009). This is attributed to the reduced evaluability of some characteristics of the options presented. In a joint evaluation, attributes that are difficult to evaluate in separate evaluation can be compared and will therefore be more important in the decision than in the separate evaluation.

Attari, DeKay, Davidson, & Bruine de Bruin (2010) show that the amount of energy saved by different measures is often not assessed correctly. They indicate that people slightly overestimate the effect of minor energy-saving measures and underestimate the effect of large energy-saving measures. This suggests low evaluability of energy savings. Therefore, providing the information about energy and money saved by different energy measures will increase the evaluability of the

proposed measures on this aspect. The type of measures that a corporation proposes is superior to many other measures in terms of energy saved per euro. So such a comparison should increase the preference for accepting these measures.

Summary

The previous discussion of theory suggests that, when proposing energy-saving measures to tenants, housing corporations can help them in their decision by presenting them with the advantages first, by describing the proposed measures as the default option, and by broadening the scope to the future and to other energy-saving measures.

To see whether these opportunities are valuable in practice and not applied already, information is gathered from tenants who recently had to make a decision about energy-saving measures, and from recent brochures including energy-saving measures. This is the subject of the next chapter.

4 Current practice: interviews with tenants and an analysis of brochures

Eleven interviews with tenants provide practical knowledge of their decision whether or not to accept the energy-saving measures to their homes that they had recently been offered. The interviews are used to check if expectations from the preliminary research hold in practice, and to assess what knowledge level can be expected in the target group for the experiment.
Four brochures that were used to inform tenants about energy-saving measures are reviewed to see if ideas from decision-making theory are applied already, and what improvements are possible.

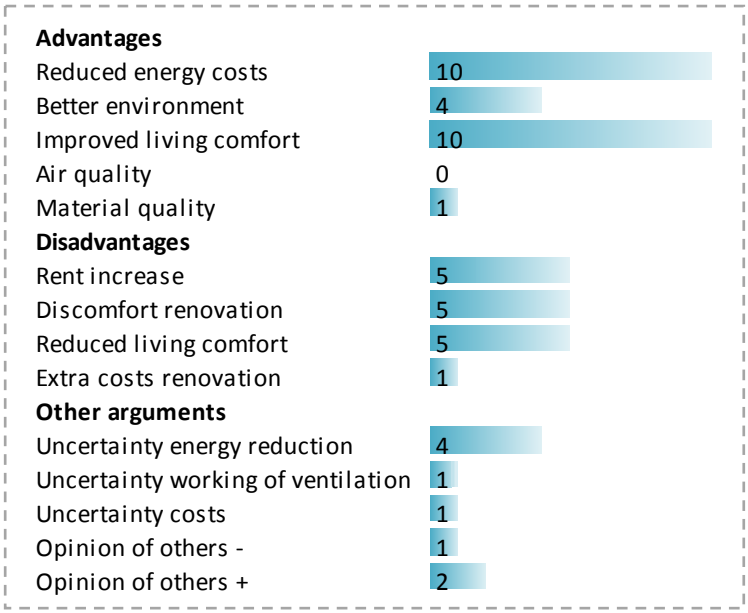
4.1 Interviews

In December 2010 and January 2011 eleven interviews were held in a neighborhood in Eindhoven, called Lismortel. In this area, housing corporation Domein recently proposed to take energy-saving measures. The work coincided with scheduled maintenance of kitchens, bathrooms, and toilets, and paintwork.
The energy-saving measures that Domein proposed in this project were low-e glazing and demand-controlled ventilation. In addition to the energy-saving measures, some other house improving measures were proposed, such as a shower cabinet, a bath, or additional kitchen cupboards. Eight interviewees had accepted the proposed energy-saving measures, three had not. The main findings and conclusions that are relevant for this research are discussed below.

Pros and cons

Interviewees were asked why they had chosen for or against the energy-saving measures and to write down how they had considered the pros and cons. Thus, the relevant arguments that tenants used are elicited. After this, respondents were asked to think of reasons that others, who are faced with the same decision, might have to choose the opposite. This prevents interviewees from only mentioning the arguments in line with their choice, i.e. advantages for accepters and disadvantages for non-accepters. Respondents had to rank the pros and cons they gave by importance, if more than one argument was given. This way the most important arguments become clear. The arguments mentioned by interviewees are compared with the arguments that were expected based on the preliminary research.
The text box below shows the advantages, disadvantages and other arguments that respondents gave and the number of times they were mentioned. The pros and cons that interviewees mentioned are generally in line with the ones expected before the interviews started. The expected advantages that interviewees named were the reduced energy costs, increased comfort of living, and the contribution to a better environment. The improvement of air quality was not mentioned, although expected. One person mentioned the improvement of the material quality of the glazing as an advantage, which was not expected.
Expected disadvantages were the rent increase, and temporary discomfort during renovation. Those were both mentioned in the interviews. Additionally, unexpected costs of renovation and reductions of living comfort were mentioned. More specifically, noise of the ventilation system, dry air and draught were thought to reduce living comfort.
Other arguments that were given, but which are not advantages or disadvantages of the proposed measures, were uncertainty about the energy reduction, uncertainty about the working of the ventilation system, uncertainty about the costs, and the opinion of others. Although uncertainty is not a disadvantage of the energy measures, it is an argument against acceptance of the energy-saving measures. The opinion of others can work both for and against acceptance.

Not everyone mentioned the same or all pros and cons. This indicates that people have different reasons for choosing for or against the energy-saving measures. Financial arguments are given very often and are generally deemed most important. Living comfort is also mentioned very often, but is reported by most respondents to be less important. However, varying arguments to choose for or against energy-saving measures should be taken into account in communication with tenants. One person indicated that increased living comfort was the most important argument to choose for the energy-saving measures, another one said contributing to a better environment to be the most important. Also one person said that improvement of the material quality of the glazing was most important. Therefore, although financial arguments seem most important, it is important to communicate all possible advantages when proposing energy-saving measures to tenants.



Comparable trade-off

The interviewees were given a hypothetical decision problem that was similar to the decision about the energy-saving measures. They had to choose between two cars to lease. One has a higher lease price and a better energy label (car B), the other higher expected fuel costs and CO_2 emissions (car A). Respondents needed to sum the costs to find that the environmentally friendlier car is €6 a month cheaper. Respondents were asked which car they would choose and why.

The trade-off between lease price and expected fuel cost reduction is comparable to the trade-off between the rent increase and the expected energy saving. Presenting interviewees with this decision problem gives insight in how they deal with it. Also, the given arguments can be compared to those mentioned for the energy-saving measures.

Two respondents did not or could not provide a logical answer at the time of the interview. Some other interviewees were reluctant to do the calculations. For communications with tenants this means that any reasoning or calculations should be presented ready-made, so that readers need to take as little effort as possible.

The arguments that respondents gave for their choice can be categorized into financial and environmental arguments. As in the decision about the energy-saving measures, financial arguments were important for most interviewees, and environmental arguments were less important.

Environmental behavior

To get an impression of how environmentally friendly the tenants behave, interviewees were first asked if they do anything to save energy, and were then asked about eight specific energy-saving measures and one other environmental measure (see text box below).

Questions about environmental behavior, translated from Dutch
Do you have incandescent lamps in your home?
When you buy a new appliance, do you take the energy label into account?
Do you own a car? If yes, did you take its fuel efficiency into account when you bought it?
Do you have insulation foil behind your radiators?
Do you buy renewable energy?
Do you intentionally use less hot water than before (e.g. by taking shorter showers)?
Have you lowered the heating temperature of your home?
Do you separate your waste?

The results suggest that respondents show environmentally friendly behavior to some extent. Almost everybody separates waste and considers the energy label when buying new appliances. Almost nobody turns the heating temperature down or puts insulating foil behind their radiators. Scores are intermediate for the other five items.
A sum score for environmentally friendly behavior is calculated for each respondent. The person whose most important argument to choose for the energy-saving measures was contributing to a better environment, has the highest sum score on environmentally friendly behavior. The person with the lowest sum score had increased living comfort as the most important argument. The rest of the scores are close to each other and halfway between the lowest and highest score.

Knowledge of energy

Several questions were asked to gain insight in tenants' knowledge level of energy consumption and energy reduction. These questions were about their own energy use, about energy prices and price development in the Netherlands, about energy consumption of home appliances, and about some energy-saving measures. Knowledge of energy appears to be limited, but not lacking. Each of the categories are discussed in turn.

Energy use

Few respondents know their annual energy use exactly in terms of gas usage and kWh, but most do know what their monthly energy bill amounts to.

Energy prices

Most respondents know that prices in the Netherlands increased over the period 2000-2010. However, only few know that prices decreased in 2010. The limited knowledge of the recent state and development of energy prices was also reflected by the questions about current unit prices. Prices incl VAT in 2010 were €0.65 per m^3 of gas and €0.18 per kWh of electricity. Less than half of the respondents provided prices at all and very few were near to the correct answer.

Energy consumption of home appliances

The annual amount of energy consumed by home appliances varies depending on the efficiency of the appliance and the frequency of use. Interviewees were asked to rank order seven home appliances according to their annual energy consumption in an average household. Table 4.1 shows the appliances, their energy use and rank, and the results of the ranking task.

Table 4.1 - Ranking of home appliances by annual energy consumption

	Annual energy use (kWh)*	Correct rank	Min. estimated rank	Max. estimated rank	Mean estimated rank	Rank of mean
Lighting (entire home)	540	1	2	7	4.55	5
Tumble dryer	440	2	1	6	2.27	1
Dishwasher	305	3	1	7	3.00	3
Washing machine	215	4	1	7	2.73	2
LCD television	138	5	1	7	4.36	4
Coffee-maker	80	6	3	7	5.73	7
Vacuum cleaner	54	7	1	7	5.36	6

*Source: Milieucentraal 2010

Respondents order the appliances reasonably well, except for lighting. Lighting of the entire home consumes more energy than any of the other appliances, but none of the respondents ranks it first. Apart from lighting, respondents quite accurately point out the appliances that consume much (tumble dryer, dishwasher, washing machine) and those that consume little (coffee-maker, vacuum cleaner).

Energy-saving measures

Nine pairs of energy-saving measures were presented to the interviewees (see the list below). For each pair, they were asked to point out the measure that would save an average household the most money in a year. Furthermore, they had to indicate how many times larger the saving was than that of the other measure of the pair.

Table 4.2 shows the pairs, the percentage of correct choices, the true ratios and the mean estimates for the ratios. There is a fair amount of correct choices, and even one item that all respondents chose correctly. Respondents do not estimate the ratio of the energy saved by the most effective compared to the less effective measure very well.

Respondents were asked if they had made comparisons similar to the last four questions when choosing whether or not to accept the energy-saving measures proposed by Domein. None of the respondents had.

Table 4.2 - Comparison of energy-saving measures

	Correct	True ratio	Mean estimated ratio
1. Lowering the thermostat vs. high efficiency combi boiler*	73%	4.2	3.9
2. Taking shorter showers vs. double glazing*	73%	3.7	2.5
3. Laptop (instead of desktop)* vs. insulating foil behind radiators	27%	2.0	0.8
4. Water-saving shower head vs. low-energy lighting*	100%	1.3	2.9
5. Cavity wall insulation* vs. solar panels	10%	2.0	0.9
6. Energy-saving measures proposed by Domein* vs. lowering the thermostat	73%	variable	0.6**
7. Energy-saving measures proposed by Domein* vs. insulating foil behind radiators	64%	variable	4.0**
8. Energy-saving measures proposed by Domein vs. cavity wall insulation*	45%	variable	0.9**
9. Energy-saving measures proposed by Domein* vs. taking shorter showers	64%	variable	1.0**

* The measures with an asterisk save more energy
** Mean difference between the real ratio, which varies per dwelling, and the estimated ratio

4.2 Review of current brochures

Four brochures of three different housing corporations are reviewed. They were used in four different maintenance and renovation projects to inform tenants about energy-saving measures. The brochures give an impression of the information currently provided to tenants on which they should base their decision to accept the energy-saving measures or not. The brochures are critically reviewed to find room for improvement. For each brochure some points for improvement are listed.

Lismortel and Muzenlaan (Eindhoven), Domein

The two brochures of the housing corporation Domein inform about the maintenance work in the neighborhoods Lismortel and Muzenlaan. Energy-saving measures are a part of those works. The interviewees of the previous section were from the Lismortel.

The brochures are similar in structure. They first describe the proposed works in four sections for the mandatory maintenance work, the optional maintenance work, the optional insulating measures, and extra optional improvements. Then, information about practicalities is provided in four sections for planning, financial compensation for inconvenience, arrangements in case of damage, and contact data. The section on the optional insulating measures is looked into.

The title of this section reads "Option: insulating measures with a (small) rent increase"[4]. This title already contains a lot of information. It starts with indicating that the measures are optional, punctuating an opt-in situation. In other words, the default is *not* to carry out the energy-saving measures. A disadvantage of the optional measures is given already, the rent increase. To point out an advantage as well, the neutral wording of *insulating* measures could have been replaced by *energy-saving*.

The introduction points out the reduced energy costs and improved living comfort as advantages and asks tenants to participate, again emphasizing the opt-in situation. The subsequent description of the proposed measures is followed by a subsection about the rent increase and another one about the reduced energy costs.

Note that the disadvantages are given before the advantages. The disadvantage in the title is followed by advantages in the introduction. In the main text, the rent increase (disadvantage) is discussed before the reduced energy costs (advantage). As discussed in chapter 3, this order is suboptimal. It increases the likelihood of rejection of the energy measures, because mentioning the disadvantage first makes rejection the initial leader.

The sections about rent increase and reduced energy costs only discuss the financial consequences of the energy-saving measures. Other arguments in favor, viz. improved living comfort and contributing to a better environment, are not elaborated. The interviews, discussed in the previous section of this chapter, showed that the arguments that tenants put forward as most important are diverse. Naming all advantages would therefore be preferred.

In the brochure for the Muzenlaan, the exact rent increase is specified, whereas the expected energy saving is not made specific. In the brochure for the Lismortel both are not specific. A more specific description would reduce uncertainty about the outcome of the decision. Such uncertainty was repeatedly mentioned as an argument against accepting the energy-saving measures in the interviews.

[4] in Dutch: "Keuze: isolerende maatregelen met een (kleine) huurverhoging"

To sum up, possible improvements for these two brochures include the following:
- do not emphasize an opt-in situation
- reverse the order of advantages and disadvantages,
- specify all advantages, and
- describe the advantages in more detail.

Bazelbuurt / Philipsdorp (Eindhoven), Woonbedrijf

The brochure of housing corporation Woonbedrijf forms part of the information provided to tenants for the district renovation of Philipsdorp. The renovations in this project are so substantial that tenants have to leave their house during the work. The energy measures are not an extra option, but part of the renovation work.

The first of four phases in this major renovation project concerns the houses in the neighborhoods Bazelbuurt and (part of) Oud-Philipsdorp. The houses are grouped into 22 types of similar build. Each type has its own brochures. Tenants receive a general brochure, an energy brochure and a social plan. The energy brochure of one type of house is reviewed.

After an introduction, the brochure describes the work on the house's exterior and installations. Then the consequences of the energy-saving measures are described in three sections for living comfort, energy label improvement and reduced energy costs. Thus, all advantages of the energy-saving measures are mentioned.

Also, the advantages come before the disadvantages. Only at the end of the last section, the rent increase is mentioned.

The description of the advantages is detailed and elaborate. The expected energy saving is specified for different levels of current energy use. The savings are given in m^3 of gas, as well as monetary. This way, the tenant can look up the expected saving for their own situation, giving them more certainty about the outcome. However, the accompanying explanation is not entirely clear. It is explained that a standard consumption of electricity for lighting and the central-heating boiler is assumed, but this does not seem relevant here. There is no reason to assume that this usage will change due to the energy measures.

Some parts of the text are somewhat unclear or less relevant. Also, a defensive stance is taken. A lot of reservations are made, which may originate from a wish to be comprehensive, but suggests that the corporation wants to safeguard itself from complaints of tenants when the results are not as expected. This might increase tenants' uncertainty about the outcomes. In some cases, the reservations are not needed and could be left out.

Summing up, the possible improvements for this brochure are:
- make the explanations clearer
- leave out information that is not or hardly relevant
- make less reservations to avoid a defensive stance

Hoogwerf (Spijkenisse), Maasdelta

In the project of housing corporation Maasdelta in the neighborhood Hoogwerf, the energy-saving measures were not combined with other maintenance work. The brochure was preceded by other communication between the housing corporation and the tenants, viz. several letters, two information meetings, and view days at a show house.

The brochure contains the following sections: an introduction, a description of the proposed work, the project planning, a list of precautionary measures to reduce inconvenience during the work, an elaboration of the financial consequences, the arrangements for complaints and damage, contact data, and a written agreement to be signed by the tenant.

The proposed work is presented as a pilot project. The brochure is titled "Information booklet energy pilot"[5]. Some tenants might hesitate to participate, when they feel that they are involved in an experiment where things could unexpectedly go wrong.
Probably due to negative responses in the preceding communication, a defensive stance is found in the brochure. After the neutral information about the proposed works and the planning, solutions to envisioned inconveniences caused by workers during the renovations are proposed. The section about the financial consequences that follows starts out with stressing the right of the corporation to demand a rent increase for house improving works. The amount demanded is then given, with the addition that the corporation pays the larger part of the investment. Such defensive arguments could make tenants, that or unsure whether to participate, suspicious. Their focus is turned to the negative arguments that the corporation is trying to rebut.
Following, some unrelated or partially connected issues concerning repairs that were put forward by tenants are discussed. Only after that, the advantages of the energy-saving measures are discussed. The energy label improvement is given and the improvement of living comfort is briefly mentioned. The expected energy saving is not mentioned. So not all advantages are mentioned and they are not made very explicit.
Maasdelta offers their tenants a living costs guarantee[6]. This should reduce uncertainty about the financial outcome. However, the explanation in the brochure is not as clear as it could be. For example, the rent increase is given, but the explanation does not tell that it is 75 percent of the expected average energy saving. The written agreement enclosed at the end of the brochure provides a clearer explanation, as well as the figures for the expected energy saving. But people might well have decided not to participate before they get to the agreement, and never read it.
All in all, the opportunities for improvement found in this brochure are similar to those found in the other brochures. They are:

- do not overly emphasize the exploratory nature of the project
- make the explanations clearer
- avoid a defensive stance
- put the advantages before the disadvantages,
- specify all advantages, and
- describe the advantages in more detail

Wrapping it up

Some of the points for improvement that are proposed here are interesting to test in an experiment. These include applications of decision making theory, such as putting the advantages before the disadvantages, and avoiding an opt-in description of the situation.
Another interesting-to-test improvement can be derived from the findings of the interviews. The addition of specific, individualized information about people's energy saving could reduce the uncertainty that was observed during the interviews. The brochure of Woonbedrijf already contains the expected energy saving for different annual amounts of gas consumption. This could be further improved by a clearer explanation and/or a calculation that also takes other individual factors into account. Different actors in an advising position propose such interventions, like (online) tools to calculate personal energy savings.
The remaining improvements that were listed above are less interesting to test in an experiment. These are used as a baseline and applied to the materials developed for the experiment.

[5] In Dutch: "Informatieboekje energiepilot".
[6] In Dutch, Woonlastenwaarborg. See also chapter 2.

5 Adapting information: hypotheses

As stated in the introduction, the aim of this research is to investigate what factors are influencing the decisions of tenants to accept or reject energy-saving measures and rent increase, and to recommend how this knowledge can be used to help tenants make more well-informed decisions.
Opportunities are found to help tenants with their decision. On the one hand, the same information can be presented in a different way to nudge people in the direction of a beneficial decision. On the other hand, information can be added that helps people in their decision.

5.1 Differing information presentation: making advantages more prominent

Decision making theory suggests that advantages can best be put before disadvantages when describing the consequences of taking energy-saving measures. This effect is further enhanced when the execution of the work is viewed as the default option or expected outcome. The review of current brochures found that most of them presented the disadvantages first and suggest the current state to be the default option. So there is room for improvement.
Also, advantages can be made more prominent by describing them in more detail. Such elaboration makes the advantages more concrete and brings them closer to the daily experience of the reader.

> Hypothesis 1: Tenants are more inclined to choose for energy-saving measures if the advantages of those measures are presented more prominently.

5.2 Adding information

Individualizing information

The interviews with tenants showed that not only advantages and disadvantages were important for their decisions, but also uncertainty about the outcomes was put forward as an important argument.
The expected energy saving varies between households. An individualized calculation of the expected energy saving reduces uncertainty of the outcome of the energy saving measures.

> Hypothesis 2: Tenants are more inclined to choose for energy-saving measures if they receive an individualized calculation of the expected energy saving.

Improving understanding and broadening the scope

People tend to focus on the present. Broadening their scope to future advantages may help them to appreciate those more. Employees of Domein indicated that the 'future advantage' argument was crucial in the decision of some tenants.

> Hypothesis 3: Tenants are more inclined to choose for energy-saving measures if they appreciate the future advantage of those measures better.

People do not assess correctly the amount of energy reduction that different energy-saving measures yield. Comparing the proposed energy-saving measures to other energy-saving measures improves tenants' knowledge of their relative advantage. Furthermore, it causes people to refer to other (financial) decisions besides the one about the rent increase for energy improvement. That way, the mental budget is no longer narrowed to housing expenses.

> Hypothesis 4: Tenants are more inclined to choose for energy-saving measures that the housing corporation proposes if they compare them with other energy-saving measures that they can take themselves.

6 Methodology

An experiment is conducted to test the hypotheses presented in the previous chapter. In the experiment, 1400 tenants of Domein and Woonbedrijf are presented with different sample brochures, sometimes supplemented with an inlay.
The experiment has eight conditions in a 2x2x2 between subjects design. Each experimental group is presented with different information. An overview of the conditions is shown in Figure 6.1 on page 39. Two brochures are written, in one of which the advantages are presented more prominently. Half of the tenants receive additional information. They either get a supplementary sheet in the brochure with an individualized calculation of the expected energy saving, or a web address where they can find additional information, or both. The experimental conditions are further elaborated in section 6.2 below.
Besides the information materials, tenants receive a questionnaire. Through the questionnaire respondents are asked their opinion about the information in the brochure and the supplementary sheet or webpage. Also, the dependent variable is measured, as well as other variables that contribute in the statistical analysis to find an effect of the conditions. The questionnaire is discussed in section 6.3. First, the general research design is explained in section 6.1.

6.1 General

The hypotheses are tested in an experiment. The advantage of an experiment over other research methods is that conclusions can be drawn with certainty about the effect of the manipulations on the dependent variable (here: acceptance of energy measures). Participants are randomly assigned to a condition. Because of the random assignment, the only explanation for a difference in the dependent variable between the different groups of participants is the different condition they were in. A condition is the combination of manipulations that a participant is subject to. The manipulations in this research are:

- the brochure with the advantages presented prominently
- the individualized calculation provided on a supplementary sheet
- the focus-broadening additional information provided on a webpage

A participant can either be subject to a manipulation or not. Since there are three manipulations, 2x2x2 combinations are possible, resulting in eight conditions.
Combining the manipulations (as opposed to testing each manipulation in a separate experiment), makes it possible to test not only the effects of the individual manipulations, but also the effect that they have together. Each of the abovementioned manipulations is expected to cause higher acceptance rates, but the effect of an additional manipulation may be smaller than that of each manipulation separately. The 2x2x2 between subjects design makes it possible to test this.

To test them, the hypotheses are actualized in information materials. Brochures are often the first substantial amount of information that people receive about planned work in their homes. Therefore, it influences the forming of opinion. This makes brochures a useful type of communication to test the hypotheses. Furthermore, this type of communication is easier to control in an experiment than other communication methods, such as presentations during an information meeting or personal communication of employees with tenants.
The works presented in the brochures are hypothetical. Also, the information in the brochures and additional information that is provided to the tenants does not reflect their own situation. To avoid confusion among tenants, it was not possible to test the hypothesis in a real project. In real projects, some people discuss the proposed work with their neighbors. Varying brochures might then be confusing and annoying to them. A comparison between different projects is not a good

option either. Participation rates substantially differ between projects due to other factors that are hard or impossible to measure and cannot be controlled for. For these reasons the research is done with a hypothetical situation.
This is likely to cause different, presumably higher, acceptance rates than in real projects. The absolute acceptance rates should therefore be interpreted with caution. However, any significant difference between experimental groups can be attributed to the manipulations with certainty, because the respondents were randomly assigned to these groups. These relative differences between the experimental groups are more interesting for this research than the absolute acceptance rates. The differences show whether the hypotheses are true.
The materials inform the tenants about planned maintenance of the kitchen, toilet, and bathroom and about proposed energy-saving measures. It is decided to include the maintenance work, because energy-saving measures are often combined with maintenance work in practice. Furthermore, in this way the primary focus of the study, acceptance of energy-saving measures, is concealed for the participants, making sure that any response biases or socially acceptable answers are kept to a minimum.

6.2 Manipulations and conditions

For each hypothesis that is formulated in the previous chapter a manipulation is designed. These manipulations are combined into eight conditions. First, the manipulations are presented, then the conditions are discussed.

Differing information presentation: brochure

The first manipulation is a variation in the brochure text. Hypothesis one predicts that tenants are more inclined to choose for energy-saving measures if the advantages of those measures are presented more prominently. Therefore, two brochures are developed that describe maintenance work and energy-saving measures. The brochures are equal except for the description of the advantages and disadvantages of the energy-saving measures. The complete brochures can be found in Appendix A – Brochures.
The base brochure, which is used for the control condition, is similar to current brochures that are used in maintenance projects. In the alternative brochure the advantages are more prominent. First of all, the position of advantages and disadvantages of the energy-saving measures is switched between brochures. Disadvantages are presented before advantages in the base brochure (as was the case with most existing brochures). In the alternative brochure, the advantages are presented first. Also, in the alternative brochure the execution of the work is presented as the default option or expected outcome. The wording in the base brochure rather emphasizes an opt-in situation. See the text box on the next page for an example from the brochure text.

Adding information

Individualizing information: supplementary sheet

Hypothesis 2 predicts that tenants are more inclined to choose for energy-saving measures if they receive an individualized calculation of the expected energy saving. Therefore, the second manipulation concerns the addition of such an individualized calculation to the brochure on a supplementary sheet. To keep the manipulation equal for all subjects, the outcome of the individualized calculation is the same for everyone.
The text suggests to them that they already provided the information that is needed for the calculation earlier, and now are given the outcome. The information that is said to be taken into account is their current annual energy-use, the number of persons in the household, the average

Base version (emphasis added)
Original text in Dutch: "Om de energiebesparende maatregelen bij u te kunnen uitvoeren, hebben we ***uw toestemming nodig***. Het zijn woningverbeterende maatregelen. Deze horen niet bij het reguliere onderhoud. Daarom vragen we er een huurverhoging voor. ***Als u besluit om mee te doen*** met de energiebesparende maatregelen, krijgt u lagere stookkosten en een gezondere, comfortabelere woning. Doordat u minder energie verbruikt, spaart u ook het milieu. Hieronder leggen we uit wat de maatregelen voor u betekenen, ***als u meedoet***."
English translation: "To carry out the energy-saving measures, we ***need your consent***. These are house improvement measures. They are not regular maintenance work. Therefore we charge a rent increase. ***If you decide to take part*** in the energy-saving measures, you will get lower heating costs and a healthier, more comfortable house. Because you use less energy, you also save the environment. Below, we explain what the measures mean for you, ***if you take part***."

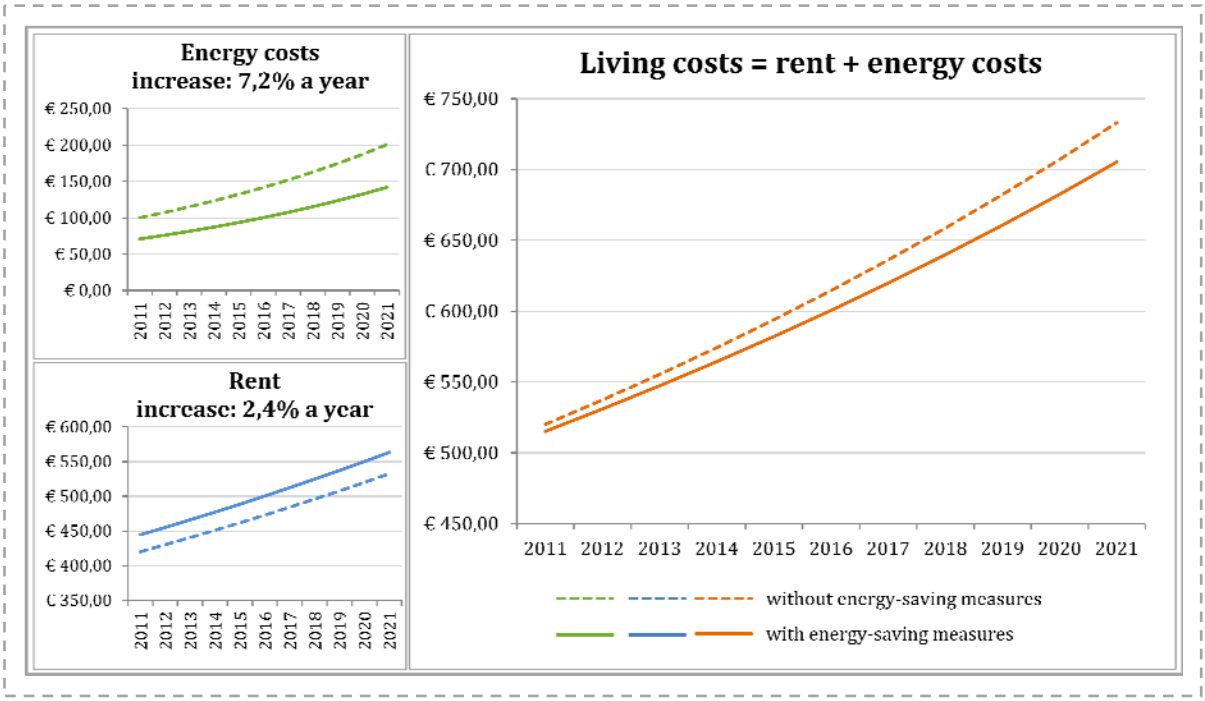
Alternative version (emphasis added)
Original text in Dutch: "De energiebesparende maatregelen ***betekenen voor u*** lagere stookkosten en een gezondere, comfortabelere woning. Doordat u minder energie verbruikt, spaart u ook het milieu. Het zijn woningverbeterende maatregelen. Deze horen niet bij het reguliere onderhoud. Daarom vragen we er een huurverhoging voor. Daar hebben we natuurlijk ***eerst uw instemming voor nodig***. Hieronder leggen we uit wat de maatregelen u opleveren.
English translation: "The energy-saving measures ***mean*** lower heating costs and a healthier, more comfortable house for you. Because you use less energy, you also save the environment. These are house improvement measures. They are not regular maintenance work. Therefore we charge a rent increase. Of course, we ***first need your assent*** for that. Below, we explain what the measures bring you."

temperature (based on thermostat settings), and whether one heats the upper floor. See Appendix B – Supplementary sheets for the complete text.
The outcome is a slightly lower energy saving than the average in the neighborhood that is given in the brochure. Still the expected saving is higher than the rent increase. Choosing a lower energy saving ensures that hypothesis two can be tested. If the individualized outcome would have been *better* than average, a positive effect of the manipulation could be caused by the extra gain. Now that it is *worse*, a positive effect of the manipulation must be attributed to the reduction of uncertainty. Choosing the individualized outcome equal to the average would not seem realistic.

Improving understanding: web page

Hypothesis 3 and 4 predict that tenants are more inclined to choose for energy-saving measures if they appreciate the future advantage of those measures better (3), and if they compare the proposed measures with other energy-saving measures that they can take themselves (4). Both hypotheses concern the improvement of understanding of the energy-saving measures and broadening the scope of the decision.
To test this, a webpage with additional information is provided. It contains three informational elements: the individualized calculation described above, an explanation of the increasing financial advantage in future, and a comparison of the proposed energy-saving measures with other energy-saving measures. The last two are the manipulations to test hypothesis 3 and 4. The web address is given on a supplementary sheet in the brochure. The exact wording of the sheet and of the web text is given in Appendix B – Supplementary sheets and Appendix C – Webpage.
The additional information is provided on a webpage, not in the brochure. The explanations would become too elaborate. Some people might not be willing to read that much and therefore decide not to participate in the research. By offering the information on a webpage, the interested reader still gets a chance to acquire the information and allows us to monitor the number of people that actually visit the website. This gives useful information about the attractiveness of providing information for tenants online.

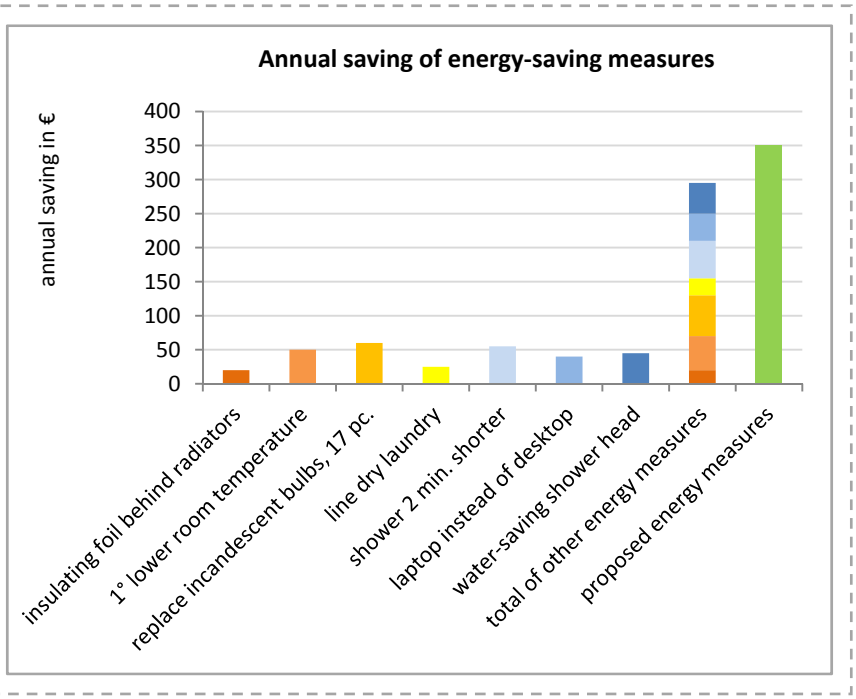
The explanation of the increasing financial advantage in the future shows that energy prizes are expected to increase more rapidly than rents, when the trends of the last ten years are extrapolated. Therefore the difference between the expected money saved on the energy bill and the rent increase grows larger over time. See the graphs below, which were also presented on the webpage.



After the explanation of the future advantage, the comparison of the proposed energy-saving measures with other energy-saving measures is presented. It has two effects. The argument that proposed energy-saving measures are very effective is elucidated. Also, thinking about other energy-saving measures will broaden the mental budget.

The proposed energy measures are compared to seven other measures. The graph on the right was presented as part of the comparison.

The influence of each element of the webpage is measured by tracking the viewing behavior of visitors. The time is measured that people watch a certain piece of text. Each piece of information is only visible when the viewer places its mouse cursor over a specified button. When the cursor is moved away, the text disappears.



Experimental conditions

The two brochures, the supplementary sheet with an individualized calculation and the web page with additional information are combined into eight conditions. They are shown in the overview below.

Mark that the respondents, that receive the web address but do not view the webpage, read the same information as the respondents that do not get the web address. The only small difference is that the first group is offered the opportunity to get additional information, although they did not use it.

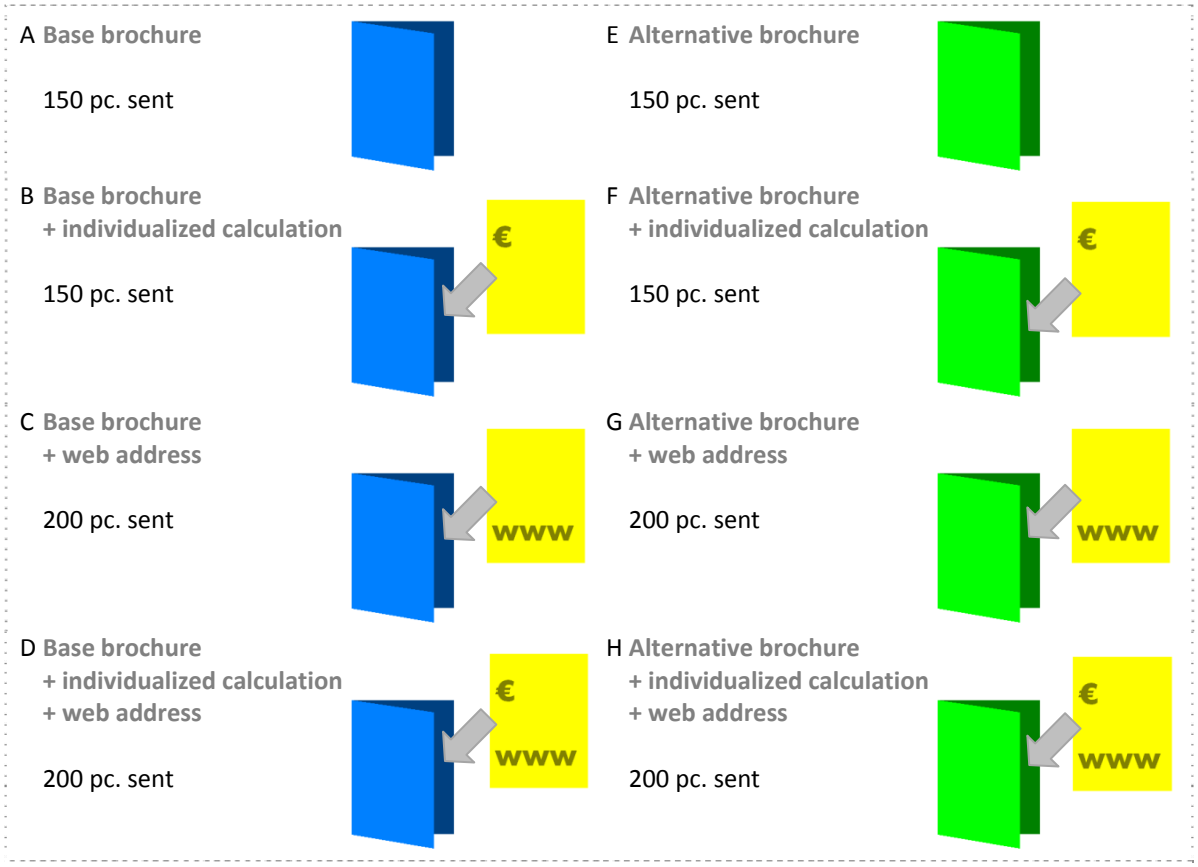


Figure 6.1 – Overview of conditions

6.3 Questionnaire

The questionnaire that accompanies the brochures contains questions about the information materials, about the decision whether to accept the proposed work, and about the respondent. There are four versions of the questionnaire. They vary according to the different materials the respondent received. The questions (in Dutch) can be found in Appendix D – Questionnaire. They are also briefly discussed below.

About the information materials

Several questions are posed about the information materials that the respondents received. Most questions used a scale to provide an answer. These are all five-point scales of which the outer points are labeled. If there is a natural center value, the center point also is. Where appropriate, 'not applicable' is provided as an extra category.

First, respondents could indicate how attentively they read the different parts of the brochure and other materials, from 'read cursory' to 'studied attentively'. More attentive reading might increase the effect of the manipulations. Then, respondents are asked to grade the materials. This gives an indication of the quality of the material. Also, a difference between the two brochure variants can be looked for.

For the different parts of the brochure and the other materials, listed in the text box below, an evaluation is asked of the amount of information (too little – exactly right – too much), the clarity of the information (very clear – very unclear), and the usefulness of the information (not useful – very useful). In part, these are mock-up questions that correspond with the research goal as presented to the respondents: an investigation into housing corporations' communication about planned work. However, might the response be more negative than expected, these variables could point out shortcomings of the brochures, such as information overload, lack of information, lack of clarity, or redundant information.

Sections of information materials to be evaluated by respondent

Brochure:	- The maintenance work
	- The work for the energy-saving measures
	- What the energy measures mean for you (pros and cons)
Inlay:	- Your personal energy saving
Webpage:	- Your personal energy saving (if not on inlay)
	- Your saving in future
	- Other energy-saving measures

About the decision

The main question for the experiment is whether people are inclined to accept the energy-saving measures or not. It is measured with a six-point-scale from 'certainly would' to 'certainly would not'. All points are labeled to clarify their meaning. The scale is symmetrical and since it has six answers, it has no neutral center point. This forces respondents to choose a positive or negative answer.

The same question is also posed for the maintenance work on kitchen, toilet and bathroom that are described in the brochure. These are mock-up questions to avoid suspicion about the purpose of research. Still, it might be interesting to see their relation to the main question.

Six-point scale for acceptance of work (in Dutch and English)

Zeker wel	Waar-schijn-lijk wel	Eerder wel dan niet	Eerder niet dan wel	Waar-schijn-lijk niet	Zeker niet
O	O	O	O	O	O
Certainly would	Probably would	Rather would, than not	Rather not, than would	Probably would not	Certainly not
O	O	O	O	O	O

After these questions, which ask people to choose for or against the proposed work, they are asked which arguments entered into their consideration. Again, the question is posed for both the maintenance work and the energy-saving measures to avoid suspicion. For each part of the work some advantages and disadvantages are suggested. Also, a category for 'other' arguments is provided, where respondents can fill in extra considerations that are not listed. These questions help to see which arguments are important in people's decisions.

Respondents are further asked how certain they are about some specific outcomes of the work. These are drawn from the information in the brochure and stated as a series of thirteen propositions. Respondents indicate their beliefs on a five-point-scale with the outer and center labels being 'certainly not true', 'uncertain', and 'certainly true'. Part of the manipulations in the experiment is intended to reduce uncertainty. These items are included to measure if uncertainty is reduced, and if the increased certainty really leads to higher acceptance.

About the respondent (demographics)

The last category of questions regards the respondent and his dwelling. These variables can be used as covariates in the analysis. Respondents are asked about their gender and age, the number of person in their household, their household income, their environmental attitude, and recent maintenance work to their home.
Household income is asked to be indicated in categories. Environmental attitude is measured with two questions. Answers are given on a five-point-scale. One question asks respondents how much effort they take to save energy, when they compare themselves to others (more – just as much – less). The other asks how engaged they feel with the environment, when they compare themselves to others (more engaged – equally engaged – less engaged).

6.4 Practicalities

Sample selection

1400 addresses are randomly selected from two databases, of Domein and Woonbedrijf. Some neighborhoods are excluded because works are being done there or planned in the near future.
The selected addresses are randomly assigned to one of eight conditions. Four experimental groups contain 150 addresses; the other four contain 200 addresses. The assignment of respondents to the conditions is random, so that differences in acceptance between the different groups can be attributed to the manipulations with certainty.

Procedure

People are approached in writing through regular mail. They first receive an announcement letter from their housing corporation. Two weeks later the questionnaire is sent together with the brochures, an accompanying letter, and a stamped self-addressed envelope. After a week and a half, a reminder letter is sent which asks people to return the questionnaire by the end of the week after (in another week and a half). In order to increase the return rate, ten gift vouchers to the value of 20 euros are put up for raffle as a reward.

Timeline of correspondence

Thursday, April 28	Announcement letter sent
Friday, May 13	Questionnaire sent
Wednesday, May 25	Reminder letter sent
Friday, June 3	Final return date given in reminder letter

6.5 Data processing and analysis

The questionnaires are marked with a unique code that makes it possible to identify the individual respondents. From this identification code, it is known which condition the respondent is in. Also, the answers in the questionnaire can be connected with other data that is known about the respondent, such as their address, housing type and the energy-label of their dwelling. The identification code is also used to log into the web page, so that these data can also be linked.
The closed-ended questions of the returned questionnaires are automatically scanned. The open-ended questions are entered by hand. The output is an excel-file with a row for each respondent and a column for each variable.

The data is analyzed using the statistical software package SPSS. The hypotheses are tested using regression analysis. Regression analysis is a statistical method to find the individual effects of different independent variables on a dependent variable. Regression analysis includes several variables at the same time and calculates their effect while taking into account what the effect of the other variables is on the dependent variable. In this case the dependent variable is the acceptance of the energy-saving measures. The independent variables are the different experimental manipulations and the covariates measured in the questionnaire (e.g. household income).
The next chapter provides a description of the data that were collected and the results of the statistical analysis.

7 Results and discussion

The results of the experiment are discussed in this chapter. The first section gives the descriptive statistics of the variables measured with the questionnaire. In the second section the hypotheses are tested and a model is developed to predict the acceptance of energy-saving measures from the measured variables and the manipulations as best as possible.

7.1 Descriptive statistics

About a quarter of the questionnaires that were sent to 1400 tenants was returned (352 pc., 25.1%). Table 7.1 shows the response rates for each condition.

Below, the dependent variable, acceptance of energy-saving measures is discussed first. The other variables are reported in the order in which they appear in the questionnaire. They are grouped in questions about the information materials, about the tenants' decision to accept, and about the tenants themselves (demographics).

Table 7.1 - Response rates per condition

condition	N sent	N returned	% returned
A	150	46	30.7%
B	150	40	26.7%
C	200	38	19.0%
D	200	47	23.5%
E	150	40	26.7%
F	150	44	29.3%
G	200	50	25.0%
H	200	47	23.5%

Dependent variable: acceptance of energy-saving measures

Respondents were asked if they would accept the energy measures after reading the brochure. They could fill in their answer on a six-point scale from 'certainly would' to 'certainly would not'. More than half of the respondents (51.3%) say that they would certainly accept the energy-saving measures if these were proposed to them. See the text box below. Another quarter of the respondents says that they probably would and about one tenth that they rather would than would not. This sums up to 87.0 percent of the respondents that would accept the energy-saving measures.

Acceptance of energy-saving measures

After reading the information, would you accept the energy-saving measures?

	%	cum.%
Certainly	51.3%	51.3%
Probably	24.9%	76.2%
Rather would, than not	10.7%	87.0%
Rather not, than would	4.6%	91.6%
Probably not	3.8%	95.4%
Certainly not	4.6%	100%

Real world percentages of acceptance are typically lower than in this sample. A possible reason for this is the hypothetical nature of the presented situation. Another explanation would be a bias towards accepting the energy measures caused by a difference between respondents and non- respondents. For example, respondents might be more committed with the environment than non-respondents, or more willing to accept requests from the corporation (e.g. to fill in a questionnaire or to accept work on their home).

The distribution of the answers is very skewed towards certain acceptance. This causes a ceiling effect, which makes it hard to find a statistically significant effect of the conditions. Common statistical methods to test the hypotheses, such as linear regression, require that the data is not skewed like this. The variable is dichotomized so that logistic regression analysis can be done.[7] The

[7] With linear regression the dependent variable is a scale variable; with logistic regression it is categorical and binary.

cut-off point is chosen between the values 'certainly' and 'probably' (on the six-point scale presented in the text box). This is a natural divide between the respondents that are certain and those that are uncertain to participate. It spreads the cases over two groups that are about equally large.
In a real project, the not-accepters are expected to be found in the second group. Persons that are uncertain about accepting the energy measures will more readily find arguments not to accept in a real project than persons that say they would certainly accept.

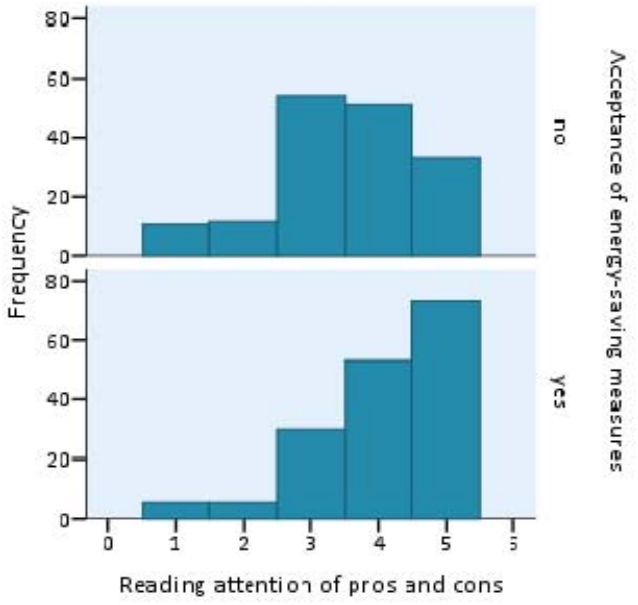
About the information materials

The first part of the questionnaire consisted of questions about reading attention, marks for the materials, and evaluations of the quantity, clarity and usefulness of the information.
The reported reading attention is similar for the different parts of the information materials. The mean scores, shown in Table 7.2, are just below four on the five-point-scale from 'read cursory' to 'studied attentively'.
The graphs show that persons who accept the energy-saving measures read the part of the brochure about the pros and cons more attentively. The difference in reading attention between the two groups of accepters and not-accepters is significant ($t(325) = -5.077$, $p = 0.000$). However, this relationship between reading attention and acceptance does not tell which is the cause and which the result. To put it differently, it does not show whether attentive reading leads to higher acceptance, or the tendency to accept makes people read more attentively.
If the first is true, it is to be expected that the manipulation of the brochure has a larger effect on someone who reads very attentively than on a cursory reader.[8] This interaction effect is not found ($b = -0.030$, $Wald(1) = 0.017$, $p = 0.898$). Therefore, it seems more likely that readiness to accept the proposed measures causes attentive reading than the other way around.

Table 7.2 - Reading attention

	N	Mean
Introduction	331	3.7
The maintenance work	330	3.8
The work for the energy-saving measures	335	3.9
What the energy measures mean for you (pros and cons)	329	3.8
Supplementary sheet with individualized calculation	170	3.7
Webpage	24	3.8

1 = cursory reading and 5 = attentively studied



Graph 7.1 (to the right) - Reading attention for accepters and non-accepters

The quality of the brochures is generally graded as good with mean marks of 7.4 for the brochure, 7.3 for the supplementary sheet and 7.0 for the webpage. Minimum grades are 3, 3 and 2 respectively; maximum grades are 10 for all three. There is only a small difference between the

[8] This is called an *interaction effect* between the brochure and reading attention: the effect of one independent variable (the brochure) on the dependent variable (acceptance) is different for different values of another independent variable (reading attention). It is also said that reading attention *moderates* the effect of the brochure on acceptance.

mean grades for the base brochure (7.4) and the alternative brochure (7.5). The difference is not significant ($t(321) = -1.123$, $p = 0.262$).

Table 7.3 shows the evaluations of the quantity, clarity and usefulness of the different parts of information. On average, the amount of information provided is assessed as about right. The average score is 2.8 while 3 means 'exactly right'. Respondents regard the information not unclear, but not very clear either. The average score of 2.4 is better than neutral (3), but quite far from the optimum (1). People find the information useful with an average score of 3.8, about halfway between neutral (3) and very useful (5).

About 30 percent of the respondents say that they miss certain information in the brochure. This mostly regards practical information about the planning of activities, sanitary services during the work, the possibilities and costs of individual options (e.g. for kitchen cabinets), the required preparations for the work (such as clearing out certain rooms), etcetera. Some respondents would like to get more detailed information about the ventilation system, some specific energy-saving measures, or their personal energy saving.

Table 7.3 - Average evaluations of materials per part of information on a five-point-scale*

	Quantity	Clarity	Usefulness
Brochure			
The maintenance work	2.8	2.2	3.9
The work for the energy-saving measures	2.8	2.3	3.9
What the energy measures mean for you (pros and cons)	2.9	2.4	3.9
Inlay/webpage			
Your personal energy saving	2.7	2.4	3.8
Webpage			
Your saving in future	2.8	2.6	3.8
Other energy-saving measures	2.7	2.7	3.7
Total average	2.8	2.4	3.8

* For quantity 1 = too little, 3 = exactly right, 5 = too much; for clarity 1 = very clear, 5 = very unclear; for usefulness 1 = not useful, 5 = very useful

About the decision

The results of the decision to accept the energy-saving measures are already discussed in the first subsection. Below, the acceptance of the maintenance work is discussed, as well as the considerations of the pros and cons, and people's certainty of the outcomes.

The acceptance of the maintenance work on the kitchen, toilet and bathroom has a distribution similar to that of the energy-saving measures, as shown in the text box below. The percentage of respondents that say they would certainly accept is a bit higher for the maintenance work.

Acceptance of maintenance work

After reading the information, would you accept the maintenance work?

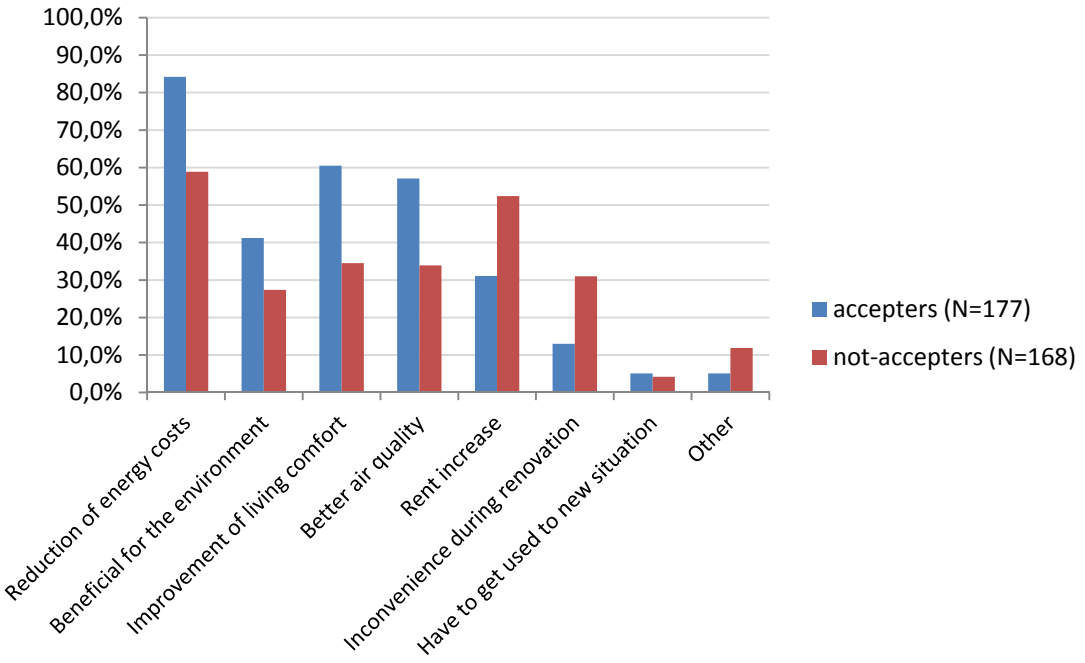
	Kitchen (*n* =346)	Toilet (*n* =345)	Bathroom (*n* =346)
Certainly	54.9%	54.8%	56.4%
Probably	21.4%	20.9%	20.5%
Rather would, than not	8.4%	7.5%	7.5%
Rather not, than would	4.3%	5.2%	4.9%
Probably not	4.0%	4.1%	3.5%
Certainly not	6.9%	7.5%	7.2%

The acceptance of maintenance work correlates with the acceptance of the energy-saving measures. However, the acceptance of the three types of maintenance work correlate stronger among themselves (see Table 7.4). It is not surprising that strong correlations are found. When one chooses to accept one type of work, the extra temporary inconvenience of the other works becomes smaller and the probability of acceptance thus increases.

Table 7.4 - Correlations of acceptance of maintenance work and acceptance of energy-saving measures9

Correlation between	and	Pearson's R	p-value	N
Maintenance kitchen	Maintenance toilet	0.748	0.000	343
Maintenance kitchen	Maintenance bathroom	0.767	0.000	344
Maintenance toilet	Maintenance bathroom	0.843	0.000	344
Maintenance kitchen	Energy-saving measures	0.468	0.000	344
Maintenance toilet	Energy-saving measures	0.497	0.000	343
Maintenance bathroom	Energy-saving measures	0.505	0.000	344

Respondents were asked which arguments entered into their consideration, when deciding to accept or reject the energy-saving measures. Different advantages and disadvantages were suggested as well as a category 'other'. Graph 7.2 shows for each argument, how many respondents indicated that it played a role in their decision to accept or not. Not surprisingly, accepters choose the advantages more often, and not-accepters choose the disadvantages more often. In both groups, the reduction in energy costs is indicated most often as an argument in their consideration. For the not-accepters the rent increase comes second and is selected about equally



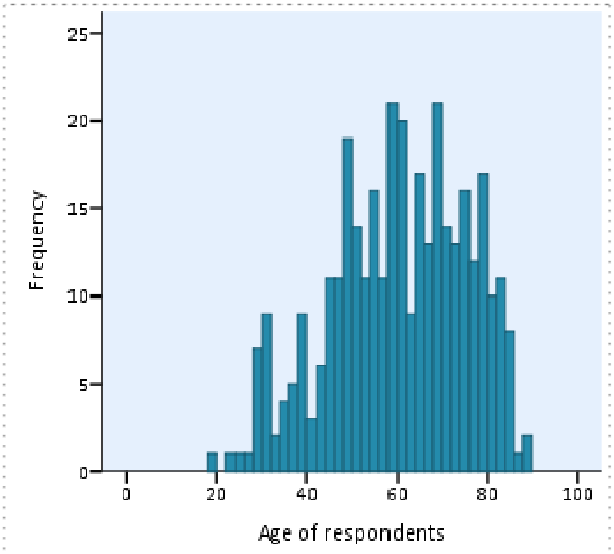
Graph 7.2 - Percentage of respondents selecting specified arguments for and against the energy-saving measures, for the two groups of accepters and not-accepters.

[9] The Pearson correlation gives the linear dependence between to variables (say, X and Y). It has a value between -1 and 1, where -1 indicates a perfect negative linear relationship (Y decreases when X increases), 1 indicates a perfect positive relationship (Y increases when X increases), and 0 indicates that the variables are independent. The Pearson's R's of the maintenance works are closer to 1 than their correlations with the energy-saving measures. Hence, the maintenance works and the energy measures are less dependent than the maintenance works among themselves.

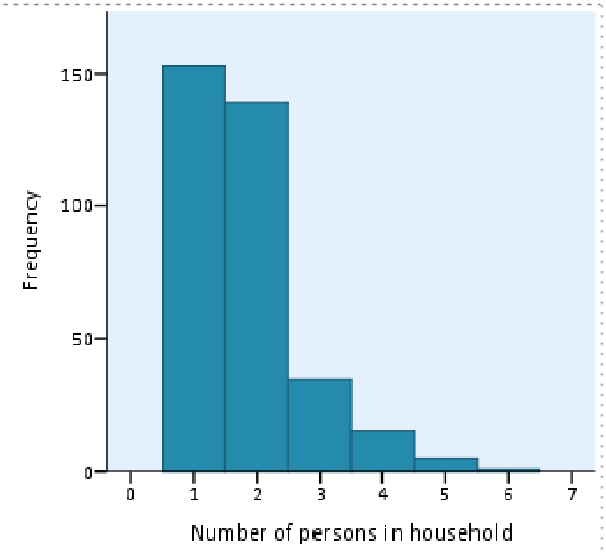
often. The accepters select the rent increase less often. They deem improvements in living comfort and air quality more important. Environmental arguments are given less often than those improvements.
Respondents were further asked how certain they are about some specific outcomes of the work. The outcomes are given as a series of thirteen propositions. A factor analysis is applied to these items. Three factors are extracted. The first is made up of the items specifically related to the energy-saving measures. The second contains the items for the maintenance works. The third consists of three more general items that represent disadvantages of the work.
As expected, a significant relation is found between the first factor, certainty about the energy-saving measures, and the acceptance of the energy measures. So, higher certainty of the outcomes is related with higher acceptance rates. The individualized calculation was meant to cause higher certainty (and thus higher acceptance rates), but this could not be confirmed.
However, the lack of this relationship may be explained by the position of the question in the questionnaire. It was posed only after respondents had indicated their choice about accepting the maintenance work and the energy measures. Therefore, something else may have been measured than certainty of the outcomes. It can be expected that respondents match their answers with the choice they made. The variable is not further used in the analysis.

About the respondents (demographics)

Of the variables that were measured to include as covariates in the regression analysis, gender, age, number of persons in the household, and recent maintenance had no effect on the acceptance of energy-saving measures. Their descriptive statistics are briefly presented below. Three other variables did have an effect on the dependent variable: self-reported effort to save energy, self-reported engagement with the environment, and household income. They are discussed thereafter.
Of the respondents 43.5 percent is male, 54.3 percent female (2.3% unknown). The age of the respondents ranges from 19 to 89 years old with an average of 60. The age distribution is shown in Graph 7.3. The majority of respondents live alone (43.5%). See Graph 7.4. The second largest group consists of two-person-households (39.5%). The largest household consists of six persons. Of all respondents, 46.6% says that maintenance has been done to their home during the past two years. The type of work varies from repairs to painting to renovations of the kitchen, toilet or bathroom to insulation and new glazing.

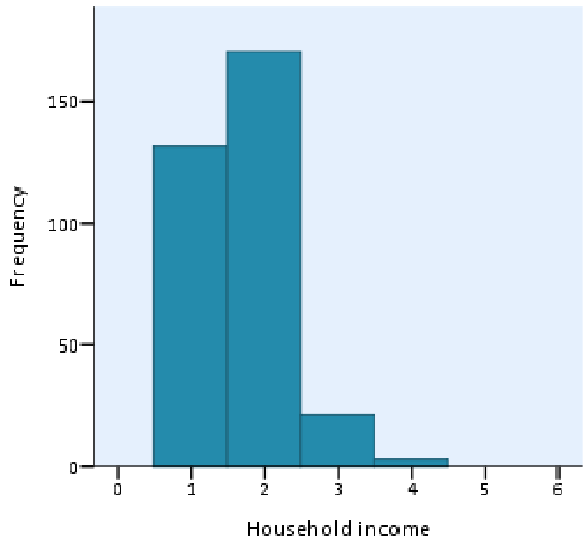


Graph 7.3 – Distribution of ages respondents



Graph 7.4 – Frequency of household sizes

Most household incomes fall into the lower two categories of 'below €20,000' and '€20,000 to €40,000' (see Graph 7.5). This is not surprising, since housing corporations have low-income households as their principal target group. For purpose of the statistical analysis described in the next section, the variable is dichotomized. The second, third and fourth category are combined into one.



Graph 7.5 – Distribution of household incomes
1 = below €20,000 ; 2 = €20,000 to €40,000 ; 3 = €40,000 to €60,000 ; 4 = €60,000 to €80,000 ; 5 = above €80.000

7.2 Hypothesis testing / inferential statistics

The effects of the improved brochure and of the individualized calculation (hypothesis 1 and 2) are tested using logistic regression. The effect of the information provided on the webpage (hypotheses 3 and 4) could not be tested. Only 28 respondents viewed the webpage. This number is not enough to do statistical analysis, even more so because they are spread over four conditions. The results that were found for the first two manipulations are discussed in this section.
Furthermore, there are three covariates that have an influence on a person's likelihood to accept the energy-saving measures: household income, effort to save energy, and environmental engagement. The effects of those variables on acceptance and the way they interact with the manipulations are also elucidated below.
The statistical results are presented in a few steps, starting with a regression model including only the experimental manipulations (brochure and individualized calculation), and including the other variables in subsequent steps.

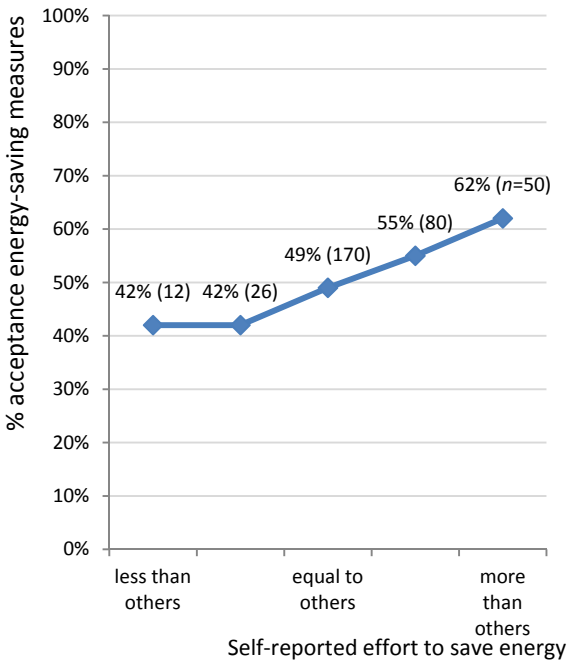
The improved brochure increases the probability that someone accepts the energy-saving measures. 48 percent of the respondents that received the base brochure accepted the energy measures. For the respondents that received the alternative brochure this proportion is 7 percent higher, 55%. However, the difference is not statistically significant ($t(343) = -1.228$, $p = 0.220$).
Such an increase is not found for the individualized calculation. The proportion of accepters is 51% both with and without the individualized calculation.

The results of the first logistic regression analysis, shown in Table 7.5, confirm the above. The improved brochure and the individualized calculations by themselves do not have a significant effect on the acceptance of energy-saving measures. However, the effect of the brochure variant is marginally significant ($p = 0.081$), suggesting that the difference in acceptance of the energy measures between the two groups might exist, though it is not statistically significant.

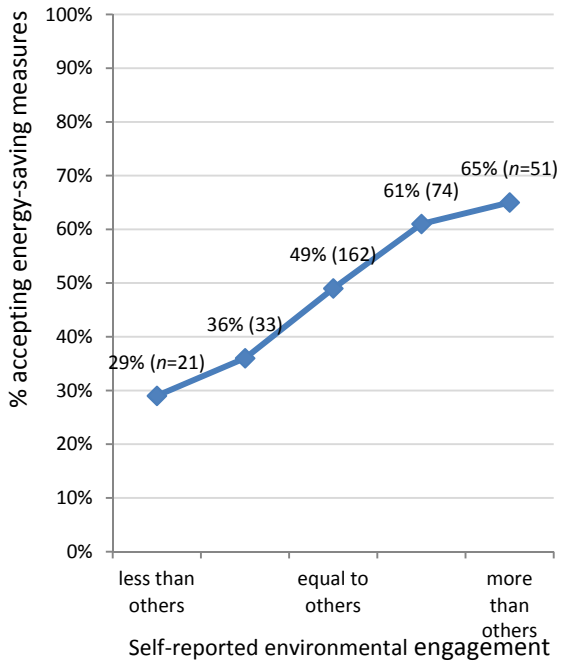
Table 7.5 - Logistic regression results for model with alternative brochure and individualized calculation as independent variables (n=345)[10]

	B	S.E.	Wald	df	Sig.	Exp(B)
Alternative brochure	**.539**	.309	3.041	1	**.081**	1.714
Individualized calculation	**.264**	.309	.733	1	**.392**	1.302
Brochure by Individualized calculation	**-.540**	.433	1.554	1	**.213**	.583
Constant	**-.218**	.221	.972	1	**.324**	.804

The effect of the alternative brochure could be obscured by other variables that have an effect on acceptance. Three variables are found that have a significant effect on acceptance. The probability of acceptance is affected by household income and by one's environmental attitude. Persons with higher household income are more likely to participate. Also, respondents indicating that they take more effort to save energy than others are more likely to accept the energy-saving measures (see Graph 7.6). Graph 7.7 shows that this is also true for respondents that regard themselves more environmentally engaged than others.



Graph 7.6 - Effect of self-reported effort to save energy on acceptance of energy-saving measures



Graph 7.7 - Effect of self-reported engagement with the environment on acceptance of energy-saving measures

[10] The p-values in the column headed "Sig." should be below 0.05 for the effect to be significantly different from 0. The size of the effect of the independent variable on the acceptance of the energy-saving measures is indicated by the values in the column headed "B". More specifically, they are the difference in the log odds of acceptance for an increase of 1 of the independent variable. For example, the log odds of acceptance increase by 0.539 for someone that received the alternative brochure (coded 1) compared to someone that received the base brochure (coded 0).

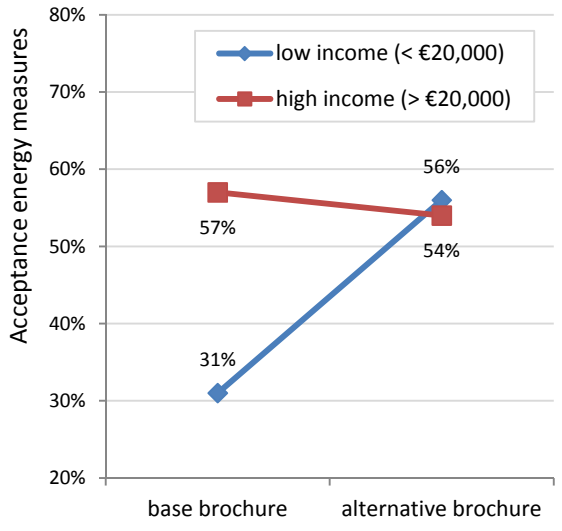
Table 7.6 shows the results of a regression analysis with household income. It shows that households with higher income (above €20.000,-) are more likely to accept the energy-saving measures ($p = 0.006$). Now, also a significant effect of the alternative brochure is found ($p = 0.005$). Also, a significant interaction of brochure and household income is found ($p = 0.012$). Together, these results show that the brochure has a strong effect for low income households but no effect for high income households.

Table 7.6 - Logistic regression results for model with alternative brochure, individualized calculation, and household income as independent variables (n=322)

	B	S.E.	Wald	df	Sig.	Exp(B)
Alternative brochure	**1.281**	.457	7.842	1	**.005****	3.600
Individualized calculation	**.336**	.465	.523	1	**.470**	1.400
Brochure by Individualized calculation	**-.463**	.461	1.007	1	**.316**	.630
High household income	**1.223**	.443	7.630	1	**.006****	3.397
Individualized calculation by High household income	**-.260**	.474	.301	1	**.583**	.771
Brochure by High household income	**-1.191**	.477	6.248	1	**.012***	.304
Constant	**-.964**	.395	5.941	1	**.015**	.382

* Effect is significant at the 0.05 level, ** Effect is significant at the 0.01 level

Graph 7.8 illustrates this. The red, upper line shows the likelihood of acceptance for high-income households; the blue, lower line that of low-income households. The high-income line is almost flat, indicating that the alternative brochure does not affect the probability of acceptance. For low-income households however, the steep slope of the lower line indicates a large effect of the brochure. The likelihood of acceptance increases to the same level as for the high-income group.



Graph 7.8 - Interaction of brochure variant with household income

Two regression analyses show that both self-reported effort to save energy and self-reported engagement with the environment have a significant effect on the acceptance of the energy-saving measures (see Table 7.7 and Table 7.8). This was also illustrated in Graph 7.6 and Graph 7.7.

Table 7.7 - Logistic regression results for model with alternative brochure, individualized calculation, and self-reported effort to save energy as independent variables (n=338)

	B	S.E.	Wald	df	Sig.	Exp(B)
Alternative brochure	**.638**	.336	3.609	1	**.057**	1.893
Individualized calculation	**.509**	.342	2.220	1	**.136**	1.664
Brochure by Individualized calculation	**-.691**	.447	2.385	1	**.122**	.501
Energy saving effort	**.488**	.204	5.714	1	**.017***	1.629
Brochure by Energy saving effort	**-.054**	.243	.050	1	**.823**	.947
Individualized calculation by Energy saving effort	**-.467**	.243	3.689	1	**.055**	.627
Constant	**-.425**	.253	2.825	1	**.093**	.654

* Effect is significant at the 0.05 level

Table 7.8 - Logistic regression results for model with alternative brochure, individualized calculation, and environmental engagement as independent variables (n=341)

	B	S.E.	Wald	df	Sig.	Exp(B)
Alternative brochure	**.654**	.335	3.806	1	**.051**	1.923
Individualized calculation	**.386**	.331	1.360	1	**.244**	1.471
Brochure by Individualized calculation	**-.643**	.450	2.039	1	**.153**	.526
Environmentally engaged	**.486**	.200	5.912	1	**.015***	1.626
Brochure by Environmentally engaged	**.041**	.228	.033	1	**.856**	1.042
Individualized calculation by Environmentally engaged	**-.201**	.227	.782	1	**.376**	.818
Constant	**-.418**	.249	2.830	1	**.093**	.658

* Effect is significant at the 0.05 level

When both characteristics are included in the model (see Table 7.9[11]), the main effect of the self-reported energy saving effort disappears. This is due to the correlation between the two variables[12] (r = 0.487, n = 343, p = 0.000). However, the interaction of energy saving effort with the individualized calculation is now significant, as well as the effect of the brochure.
So the alternative brochure increases the probability of accepting the energy-saving measures when it is taken into account that persons with high environmental attitude are already more likely to participate.

Table 7.9 - Logistic regression results for model with alternative brochure, individualized calculation, effort to save energy, and environmental engagement as independent variables (n=338)

	B	S.E.	Wald	df	Sig.	Exp(B)
Alternative brochure	**.704**	.331	4.527	1	**.033***	2.022
Individualized calculation	**.607**	.348	3.046	1	**.081**	1.834
Brochure by Individualized calculation	**-.759**	.456	2.766	1	**.096**	.468
Energy saving effort	**.250**	.181	1.911	1	**.167**	1.284
Individualized calculation by Energy saving effort	**-.511**	.249	4.199	1	**.040***	.600
Environmentally engaged	**.438**	.132	10.950	1	**.001***	1.550
Constant	**-.524**	.252	4.336	1	**.037***	.592

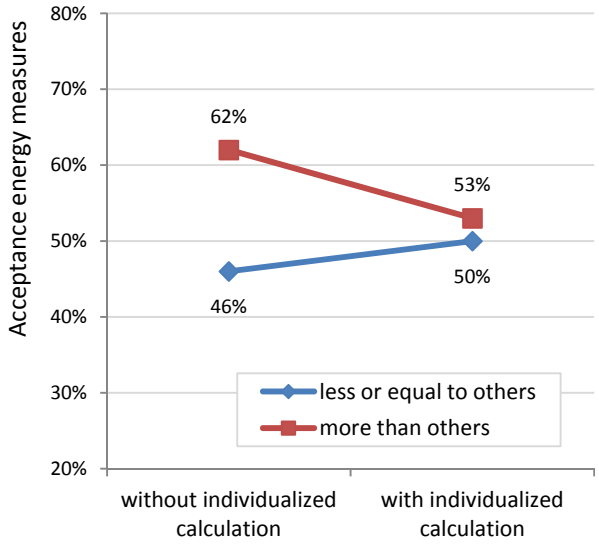
* Effect is significant at the 0.05 level

[11] The interaction effects that were not significant are excluded from the model to prevent unnecessary covariations from obscuring the results.
[12] When two independent variables in a regression analysis correlate, the effect of only one or of neither is found, because the two variables explain variation in the dependent variable in a similar way.

The interaction effect is illustrated in Graph 7.9. It shows a negative effect of the individualized calculation for persons who take more effort to save energy. The effect for persons who take little effort to save energy, on the other hand, is positive.

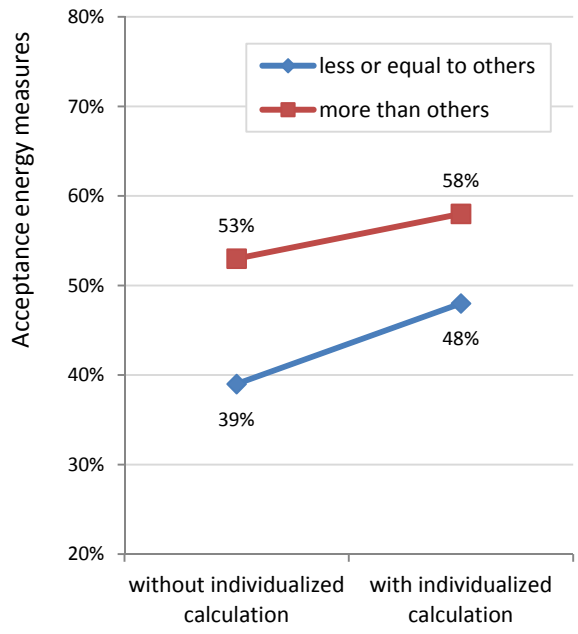
To investigate this unexpected negative effect, a split is made between the respondents who received the base brochure and those who received the alternative brochure. The graph is then redrawn for both groups. This results in Graph 7.10 and Graph 7.11.

These graphs show that the negative effect only occurs in the group of respondents that received both the alternative brochure and the individualized calculation[13]. For all other groups the individualization has a marginal positive or no effect. This is reflected in its marginal significance (p = 0.081) in the regression model.

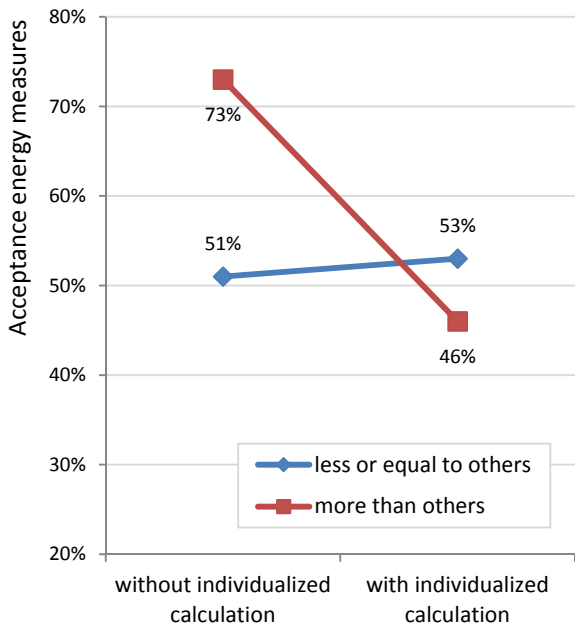


Graph 7.9 - Interaction of energy saving effort with individualized calculation

The effect was not hypothesized and has no evident explanation. An explanation that might be thought of is a disappointment in the expected individual energy saving, because the saving is



Graph 7.10 – Interaction of energy saving effort with individualized calculation for respondents receiving base brochure



Graph 7.11 – Interaction of energy saving effort with individualized calculation for respondents receiving alternative brochure

[13] The graphs suggest a three-way interaction of Brochure, Individualized calculation and Energy saving effort. This interaction is tested in a full factorial regression model of those three variables. The three-way interaction is marginally significant (p = .082); none of the other variables and interactions have significant effects.

slightly smaller than the average expected energy saving presented in the brochure. The enthusiasm of the group of energy savers is fed by the improved brochure and the disappointment is therefore the larger. Even more so because this group will be more sensitive to arguments regarding energy saving.

All previously discussed variables and their significant interactions are combined in one regression model. The results are given in Table 7.10. The interaction effect of the individualized calculation with the self-reported energy-saving effort is no longer significant. This is caused by an increased number of missing values (for household income) in this analysis.[14] All other effects remain, including the interaction of brochure with household income.

Table 7.10 - Logistic regression results for model with alternative brochure, individualized calculation, household income, effort to save energy, and environmental engagement as independent variables (n=318)

	B	S.E.	Wald	df	**Sig.**	Exp(B)
Alternative brochure	**1.364**	.472	8.356	1	**.004****	3.912
Individualized calculation	**.519**	.368	1.996	1	**.158**	1.681
Brochure by Individualized calculation	**-.658**	.477	1.909	1	**.167**	.518
High household income	**.958**	.366	6.852	1	**.009****	2.607
Brochure by High household income	**-1.056**	.491	4.623	1	**.032***	.348
Energy saving effort	**.239**	.189	1.603	1	**.205**	1.270
Individualized calculation by Energy saving effort	**-.486**	.259	3.526	1	**.060**	.615
Environmentally engaged	**.411**	.139	8.784	1	**.003****	1.508
Constant	**-1.109**	.364	9.274	1	**.002****	.330

* Effect is significant at the 0.05 level, ** Effect is significant at the 0.01 level

In conclusion, people's environmental attitude and income level influence the probability of accepting energy-saving measures. Taking into account that persons that are more concerned with the environment will more readily participate, and that households with higher income are more likely to participate too, the probability of acceptance is further raised by the prominent presentation of advantages in the alternative brochure. Therefore, hypothesis 1 (formulated in chapter 5) is true.

Hypothesis 2 is not confirmed. The effect of the individualized calculation on the likelihood of acceptance is marginally positive and not significant, except for a specific group of persons that take more effort to save energy than others. For them, the effect is negative -opposite to the hypothesis- but only when they received the individualized calculation in combination with the improved brochure. Remember that the individualized energy saving was lower than the average that was presented in the brochures. This may be an explanation of the insignificant and negative effects.

Hypotheses 3 and 4 could not be tested due to an insufficient number of webpage views.

[14] Cases are excluded when a value for one (or more) of the variables in the model fails. When the regression analysis is done without Household income in the model but with the same cases that are used in the combined model, the interaction between Individualized calculation and Energy saving effort is also not significant. Therefore, this must be caused by the missing values.

8 Conclusions and recommendations

The aim of this research is to investigate what factors are influencing the decisions of tenants to accept or reject energy-saving measures and rent increase, and to recommend how this knowledge can be used to help tenants make more well-informed decisions. The research focuses on choice situations where the acceptance of the energy-saving measures is the rational choice for the tenant.
Information is gathered from previous research in decision making and from experience in practice through interviews and a brochure review. Some promising opportunities to help tenants make more well-informed decisions were found. These are translated into four hypotheses which are tested by applying the proposed improvements to information materials and measuring their effect on acceptance of energy measures in an experiment. The developed materials comprise two brochures about planned work, a supplementary sheet about the expected individual energy saving, and a webpage with extra information.

The decision making research suggests that the presentation of the decision problem to the tenant can be designed to enhance the expected rational preference. Advantages of the energy-saving measures are made more prominent by discussing the advantages before the disadvantages, and by describing the execution of the works as the default conduct. The effectiveness of thus tuning the presentation (hypothesis 1) is tested by means of comparing the willingness to accept the proposed energy measures for two different brochures.
A significant effect of the alternative brochure is found, when controlling for household income and environmental attitude. Respondents with higher income and respondents that care more about the environment already are more likely to accept the energy-saving measures. Taking this into account, the improved brochure further raises the likelihood of acceptance. For high-income households the brochure has no effect. On the other hand, for low-income households it has a substantial effect.

The interviews with tenants pointed out people's uncertainty about the outcomes as an important reason not to accept the measures. They wonder if the general figures mentioned by the corporation will also apply to their individual situation. Such uncertainty can be reduced by providing an individualized calculation of the expected energy saving (hypothesis 2). The effect of that is tested with a supplementary sheet in half of the brochures.
Only a marginal positive effect is found for most respondents, and a substantial negative effect is found for respondents that take much effort to save energy and that also received the improved brochure. So, for part of the tenants, the combination of the alternative brochure and the individualized calculation causes a decrease in willingness to accept the energy-saving measures. This is a very undesirable effect.
It seems advisable to use the improved brochure to nudge tenants to accept energy-saving measures and not the individualized calculation, because of the substantial positives effect found for the improved brochure (for low-income households) and the negative effect found for the individualized calculation in combination with the brochure (for enthusiastic energy-savers).
However, the explanation of the negative effect of the individualized brochure for enthusiastic energy-savers is not known. A possible explanation is the disappointment in the lower individual energy saving, compared to the average saving presented in the brochure. If this explanation is true, the individualization of information itself might still have a positive effect on acceptance. The effect of a higher individual energy saving was not tested. In order to confirm the proposed explanation, this should be tested. Until then, hypothesis 2 cannot be confirmed nor rejected.

Such an experiment would provide interesting information for use in practice. Individualized calculations are often asked for by tenants[15], and are suggested as helpful tools by consultants (Weevers, personal communication) and consumer interest groups (Woonbond, Milieucentraal). If the proposed explanation is validated by research, this has interesting consequences for the communication of average and individual expected energy savings to tenants. It may be wise not to mention the average in advance of the individual calculations. Also, if higher individual saving increase acceptance, a lower anchor may be set than the average (e.g. the median, or the minimum). That way, more tenants will have a higher individual value.

The other two hypotheses, which involved the webpage with extra information, could not be tested due to lack of sufficient data. More than half of the addressees received a web address where they could look up extra information about their energy saving in the future and about the effectiveness of the proposed measures compared to other options to save energy. Only 28 respondents actually viewed this page. This amount is insufficient to do inferential statistical analysis.

A webpage apparently was not the right medium to test the effect of focus-broadening information. This might mean that providing (extra) information online is not advisable in real projects either. However, people will be more inclined to take the effort of looking up the information when it regards their own real situation than for a hypothetical one such as this research.

The effects that were to be tested by means of the webpage remain interesting to investigate. They might be tested using another medium or a different group of respondents. The hypotheses predicted that broadening the tenants' scope from the present to the future and from the proposed energy measures to other energy-saving measures would increase their likelihood of acceptance. These ideas were not encountered in current brochures or in the advice of experts. However, they are supported by decision making theory about time preference and mental accounting. It would be interesting to find an application in practice for these theories.

[15] Personal communication with corporation employees and the answers to the questions about missing information in the questionnaire indicate this.

References

Aedes. (2010). Zó raken bewoners enthousiast voor energiebesparing. *Aedes-Magazine, 19,* 16-19.

Aedes & Nederlandse Woonbond. (2009). Woonlastenwaarborg bij energiebesparing. (Brochure)

Agentschap NL. (2011). Voorbeeldwoningen 2011: Bestaande bouw.

Attari, S.Z., DeKay, M.L., Davidson, C.I., & Bruine de Bruin, W. (2010). Public perceptions of energy consumption and savings. *Proceedings of the National Academy of Sciences of the United States of America (PNAS).* Published online before print August 16, 2010, doi: 10.1073/pnas.1001509107.

Europa.eu. (2007, February 14). Energy efficiency: energy performance of buildings. Retrieved from http://europa.eu/legislation_summaries/other/l27042_en.htm

Europa.eu (2009, March 29). Energy efficiency for the 2020 goal. Retrieved from http://europa.eu/legislation_summaries/energy/energy_efficiency/en0002_en.htm

Europa.eu. (2010, June 14). Kyoto Protocol on climate change. Retrieved from http://europa.eu/legislation_summaries/environment/cooperation_with_third_countries/l28060_en.htm

European Parliament. (2002). *Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings.* Official Journal of the European Communities.

Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic Perspectives, 19*(4), 25-42

Hardman, D. (2009). *Judgment and decision making: psychological perspectives*. Wiley-Blackwell.

Johnson, E.J. & Goldstein, D. (2003). Do defaults save lives? *Science, 302,* 1338-1339.

Johnson, E.J., Keinan, A., & Häubl, G. (2007). Aspects of endowment: a query theory of value construction. *Journal of Experimental Psychology, 33,* 461-474.

Kahneman, D. & Tversky, A (1984). Choices, values, and frames. *American Psychologist, 39,* 341-350.

Milieucentraal. (2010). Retrieved from http://www.milieucentraal.nl

NIBUD (2009). Energielastenbeschouwing: Verschillen in energielasten tussen huishoudens nader onderzocht. Utrecht.

Russo, J.E., Carlson, K.A., & Meloy, M.G. (2006). Choosing an inferior alternative. *Psychological Science, 17*, 899-904.

Thaler, R.H. & Sunstein, C.R. (2009). *Nudge: Improving Decisions about Health, Wealth and Happiness.* London: Penguin Books Ltd

Thaler, R.H., Sunstein, C.R., & Balz, J.P. (n.d.). Choice architecture. Retrieved from http://ssm.com/abstract=1583509

Weevers, L. & Go, S.T.K. (2010). *Energiebesparing en huurverhoging: De barrières voorbij* (3rd ed.).

List of persons interviewed and consulted

Name	Organization	Function
Hella Maessen	Atriensis	Senior projectmanager
Bert Weevers	Builddesk	Strategisch adviseur
Evie Kerkhof	Deerns	Engineer sustainability
Ria Appelo	Domein	Sectormanager Strategie & beleid
Robert Arts	Domein	Projectleider Strategie & beleid
Anita Dahmen	Domein	Gebiedscoördinator Best, afd. Klanten
Leo Paans	Domein	Senior projectleider Vastgoedbeheer
Jeroen Rijkers	Domein	Senior projectleider Vastgoedbeheer
Arnie van de Veerdonk	Domein	Directeur
John Zuidmeer	Maasdelta	Manager Vastgoedbeheer
Irene Mobach	Milieucentraal	Consultant on communication of environmental issues
Jaap van Leeuwen	Nederlandse Woonbond	Energieconsulent
Onno van Rijsbergen	Nederlandse Woonbond	Adviseur woningkwaliteit en binnenmilieu
Doris de Bruijn	SlimRenoveren	Renovation consultant and owner
Sean Vos	SlimRenoveren	Renovation consultant and owner
Hamid Dardour	Woonbedrijf	Onderzoeker
Peter van Herk	Woonbedrijf	Projectleider Rapenland
Esther Kokx	Woonbedrijf	Bewonersbegeleidster
Gerda Lakeman	Woonbedrijf	Bewonersbegeleidster Philipsdorp
Marion vd Mortel	Woonbedrijf	Senior planontwikkelaar
Linda Tuijt	Woonbedrijf	Adviseur Vastgoed

Appendix A – Brochures

This appendix gives a brief account of choices made in the development of the brochures that are used in the experiment. The complete brochures are included after that.

The brochures resemble existing brochures that housing corporations use to communicate planned work to their tenants. The outline is similar to those of Domein: Introduction, description of maintenance work, description of work for energy-saving measures, explanation of consequences of energy-saving measures.

The brochures present maintenance work and energy-saving measures for a terraced house. This type of dwelling and the assumed current state (see text box) are common in the Dutch housing sector (AgentschapNL, 2011). The label improvement connected with the proposed works is substantial and realistic. The expected energy saving is based on the online tools that Milieucentraal provides (Milieucentraal, 2010) and is confirmed as realistic by an expert (Hella Maessen, personal communication, April 4, 2011).

Assumed current state
Terraced house
Kitchen of 15 years old
Toilet and bathroom of 25 years old
50 mm roof insulation
Non-insulated cavity walls
Double glazing on ground floor, single glazing upstairs
Natural ventilation
Energy label D

Proposed work
Renovation of kitchen
Renovation of toilet
Renovation of bathroom
Replacement of roof insulation (from 50 to 100 mm)
Cavity wall insulation
Replacement of window frames and glazing (from single/double glass to low-emissivity glass)
Demand-driven mechanical ventilation
Improvement of energy label to B

The part of the brochure regarding maintenance works is kept as brief as possible so as not to make people read much more than needed for the research.

The description of advantages and disadvantages contains all those that were found in preliminary research. During the interviews different people indicated different arguments as most important. Therefore, it is important to use all arguments in order to address all readers.

The rent increase (disadvantage) and the monetary saving (advantage) are named separately. The interviews suggested that they should rather be combined in communication with tenants in order to reduce the effort of understanding the outcome. That way, tenants do not need to work out the sum themselves. For the experiment however, the advantages and disadvantages needed to be separated.

The differences between the two brochures are found on page 6 and 7. The rest of the brochure is the same. On the next pages, the complete base brochure is included followed by pages 6 and 7 of the alternative brochure.

The order of the advantages and disadvantages described on those pages is reversed. Wording is chosen so that in the alternative brochure the execution of the works is the normal way of conduct. In the base brochure the opt-in situation is more emphasized. Also, in the alternative brochure more detail is provided of the advantages.

Base brochure, complete

INLEIDING

Binnenkort start Woonbedrijf/Domein met groot onderhoud in uw buurt. Deze brochure bevat informatie over de werkzaamheden.

Uw huidige keuken is 15 jaar oud, uw toilet en badkamer 25 jaar. Daarom verdienen ze een onderhoudsbeurt. De werkzaamheden omvatten vernieuwing van keuken, toilet en doucheruimte. Verder brengen we energiebesparende maatregelen aan. Die bestaan uit isolatie van gevel en dak, nieuwe kozijnen met isolerend glas en mechanische ventilatie. Hierdoor krijgt u lagere stookkosten[1] en een gezonde, comfortabele woning. Voor de energiebesparende maatregelen vragen we een huurverhoging.

De werkzaamheden aan uw woning duren ongeveer 4 weken als u aan alle werkzaamheden meedoet. U krijgt later nog een gedetailleerde planning, waarin staat op welke dagen we welke werkzaamheden bij u verrichten.

[1] Dit geldt bij gelijkblijvende omstandigheden, zoals uw gezinssituatie en stookgedrag, maar ook weersomstandigheden in de winter.

ONDERHOUD AAN KEUKEN, TOILET EN BADKAMER

We vernieuwen uw keuken, toilet en badkamer. Hieronder is beschreven wat we precies doen. Deze werkzaamheden horen bij het reguliere onderhoud. Daarom betaalt u er geen huurverhoging voor. Als u bepaalde werkzaamheden niet wilt laten uitvoeren, bijvoorbeeld omdat u zelf een keuken heeft geplaatst, dan kunt u dat bij ons aangeven..

Werkzaamheden

Keuken

In de keuken vervangen we de keukenkastjes, het aanrechtblad en de mengkraan. Ook brengen we nieuwe wandtegels aan.

Toilet

Op het toilet vervangen we de toiletpot, de spoeling, het fonteintje en de kraan. Verder brengen we nieuwe wandtegels en vloertegels aan.

Badkamer

In de badkamer vervangen we de douchemengkraan met toebehoren, de wastafel met mengkraan, het planchet en de spiegel. Verder brengen we nieuwe wandtegels en vloertegels aan. Indien aanwezig, vervangen we ook de toiletpot en spoeling.

Keuzemogelijkheden

U heeft een aantal keuzes voor de kleur van de keukenkastjes, het type handgreepjes, het aanrechtblad en voor het tegelwerk in zowel de keuken, als het toilet en de badkamer. De keuzemogelijkheden kunt u binnenkort bekijken in de modelwoning en bespreken met een van onze medewerkers. U krijgt hiervoor een aparte uitnodiging.

ENERGIEBESPARENDE MAATREGELEN

We isoleren uw woning en brengen vraaggestuurde mechanische ventilatie aan. Hieronder is beschreven wat deze energiebesparende maatregelen precies inhouden.

Werkzaamheden

Isolatie dak

Aan de binnenkant van het schuine dak vervangen we de huidige isolatie van 5 cm door nieuwe isolatie van 10 cm. Dit heeft een witte vlakke afwerking.

Isolatie gevel

In de spouwmuren van de voor- en achtergevel brengen we isolatie aan. Heeft u een hoekwoning, dan isoleren we ook de zijgevel. Vanaf de buitenkant boren we enkele gaten in de muur. Door die gaten spuiten we het isolatiemateriaal in de spouw. Daarna maken we de gaten weer dicht.

Nieuwe kozijnen met HR++ glas

We vervangen de kozijnen en beglazing. Bij het plaatsen van de nieuwe kozijnen maken we de aansluiting met de gevel kierdicht. In de kozijnen plaatsen we isolerend HR++ glas en ventilatieroosters.

Vraaggestuurde mechanische ventilatie

We plaatsen een mechanisch ventilatiesysteem. Dat zuigt lucht af vanuit de keuken, het toilet en de badkamer. De aanvoer van verse lucht komt van buiten door de nieuwe ventilatieroosters.

Ventileren is belangrijk voor de luchtkwaliteit, zeker als uw woning door de isolatie en de nieuwe kozijnen kier- en luchtdichter wordt.

De ventilatie is vraaggestuurd. Dat betekent dat de ventilator vanzelf harder gaat als er meer lucht ververst moet worden en zachter als dat minder nodig is. In de woonkamer plaatsen we een sensor, die meet hoeveel CO_2er in de lucht zit. Het CO_2-gehalte bepaalt hoe hard de ventilator draait.

Wat betekenen de energiemaatregelen voor u?

Om de energiebesparende maatregelen bij u te kunnen uitvoeren, hebben we uw toestemming nodig. Het zijn woningverbeterende maatregelen. Deze horen niet bij het reguliere onderhoud. Daarom vragen we er een huurverhoging voor. Als u besluit om mee te doen met de energiebesparende maatregelen, krijgt u lagere stookkosten[2] en een gezondere, comfortabelere woning. Doordat u minder energie verbruikt, spaart u ook het milieu. Hieronder leggen we uit wat de maatregelen voor u betekenen, als u meedoet.

Huurverhoging

Voor de energiebesparende maatregelen berekenen we een huurverhoging die in de meeste gevallen lager is dan de energiebesparing. De huurverhoging bedraagt €24,38 per maand. Dat is 75% van de berekende gemiddelde energiebesparing van de woningen in uw buurt.

Overlast bij uitvoering

De werkzaamheden geven, evenals het onderhoud aan keuken, toilet en badkamer, tijdelijk enige overlast. Voor het isoleren van het dak en voor het aanbrengen van de ventilatie moeten de werklieden bij u binnen zijn. Van u verwachten we dat u van tevoren de plekken vrij maakt waar gewerkt wordt, zodat er geen spullen in de weg staan.
Bij het vervangen van de kozijnen staat het aangrenzende vertrek in directe verbinding met buiten. Per gevel hebben we één dag nodig om de kozijnen te vervangen.

Even wennen

Na de werkzaamheden moet u wellicht even wennen aan de nieuwe situatie. Het nieuwe ventilatiesysteem zorgt voor andere lucht-stromingen in huis. Misschien moet u opnieuw uitvinden hoe u uw thermostaat het beste in kunt stellen. Als u het op prijs stelt, kunt u ons hierbij om advies vragen.

[2] bij gelijkblijvende omstandigheden, zoals uw gezinssituatie en stookgedrag.

Energiebesparing

Door de energiebesparende maatregelen bespaart u op uw stookkosten. Isolatie is een erg effectieve manier van energie besparen.
Volgens berekeningen is de energiebesparing in de meeste gevallen hoger dan de huurverhoging. De besparing verschilt per huishouden, omdat het energieverbruik onder andere afhankelijk is van uw (stook)gedrag.
De verwachting is dat de gasprijs in de toekomst sterker stijgt dan de huur. Daardoor bent u op termijn waarschijnlijk nog voordeliger uit.

Energielabel

De woningen in uw buurt hebben een gemiddeld energielabel D. Als iedereen de energiebesparende maatregelen laat uitvoeren, verbetert dit gemiddelde naar energielabel B.

Binnenklimaat

Het vraaggestuurde ventilatiesysteem zorgt ervoor dat de lucht altijd voldoende ververst wordt. Dit zorgt voor een gezonde luchtkwaliteit en voorkomt vochtproblemen. Doordat het systeem vraaggestuurd is, ventileert het alleen hard als dat nodig is. Zo verbruikt de ventilator minder energie dan niet-vraaggestuurde systemen.

Comfort

Als u meedoet, verhogen de maatregelen het comfort van uw woning. De isolatie zorgt ervoor dat uw woning langer op een aangename temperatuur blijft. Doordat we de nieuwe kozijnen kierdicht aanbrengen, kan er geen tocht meer langs de ramen komen.

Dit is een voorbeeld van een onderhoudsbrochure ten behoeve van het afstudeeronderzoek van Rianne Wolters aan de Technische Universiteit Eindhoven. De brochure is samen met een vragenlijst verspreid onder een deel van de huurders van de woningcorporaties Domein en Woonbedrijf.

Heeft u vragen over deze brochure of de bijbehorende enquête, dan kunt u contact opnemen via 040-2329921 of m.j.wolters@student.tue.nl

Wat betekenen de energiemaatregelen voor u?

De energiebesparende maatregelen betekenen voor u lagere stookkosten[2] en een gezondere, comfortabelere woning. Doordat u minder energie verbruikt, spaart u ook het milieu. Het zijn woningverbeterende maatregelen. Deze horen niet bij het reguliere onderhoud. Daarom vragen we er een huurverhoging voor. Daar hebben we natuurlijk eerst uw instemming voor nodig. Hieronder leggen we uit wat de maatregelen u opleveren.

Flinke energiebesparing

Door de energiebesparende maatregelen bespaart u op uw stookkosten. Isolatie is een erg effectieve manier van energie besparen. Het levert bijvoorbeeld meer op dan gloeilampen vervangen of de verwarming een graad lager zetten.
Voor de woningen in uw buurt is de verwachte gemiddelde besparing per woning €390 per jaar[3]. Per maand is dat €32,50. Dit bedrag is een schatting. De werkelijke energiebesparing verschilt per huishouden, omdat het energieverbruik onder andere afhankelijk is van uw (stook)gedrag.
De verwachting is dat de gasprijs in de toekomst sterker stijgt dan de huur. Daardoor bent u op termijn waarschijnlijk nog voordeliger uit.

Verbetering energielabel

Door de energiebesparende maatregelen verbetert het gemiddelde energielabel in uw buurt naar B. De woningen in uw buurt hebben nu een gemiddeld energielabel D.

Gezond binnenklimaat

Het vraaggestuurde ventilatiesysteem zorgt ervoor dat de lucht altijd voldoende ververst wordt. Dit zorgt voor een gezonde luchtkwaliteit en voorkomt vochtproblemen. Doordat het systeem vraaggestuurd is, ventileert het alleen hard als dat nodig is. Zo verbruikt de ventilator minder energie dan niet-vraaggestuurde systemen.

[2] bij gelijkblijvende omstandigheden, zoals uw gezinssituatie en stookgedrag.

[3] gebaseerd op een verwachte besparing van 730m³ gas à €0,53.

Verhoging comfort

Daarnaast verhogen de maatregelen het comfort van uw woning. De isolatie zorgt ervoor dat uw woning langer op een aangename temperatuur blijft. In de winter koelt het minder snel af, in de zomer warmt uw woning juist minder snel op. De nieuwe beglazing isoleert beter dan het huidige dubbelglas. Ter vergelijking: de energiebesparing door de stap van gewoon dubbelglas naar HR++ glas is bijna even groot als bij vervanging van enkelglas door dubbelglas. Doordat we de nieuwe kozijnen kierdicht aanbrengen, kan er geen tocht meer langs de ramen komen.

Huurverhoging

Voor de energiebesparende maatregelen berekenen we een huurverhoging die in de meeste gevallen lager is dan de energiebesparing. De huurverhoging bedraagt €24,38 per maand. Dat is 75% van de berekende gemiddelde energiebesparing van de woningen in uw buurt.

Overlast bij uitvoering

De werkzaamheden geven, evenals het onderhoud aan keuken, toilet en badkamer, tijdelijk enige overlast. Voor het isoleren van het dak en voor het aanbrengen van de ventilatie moeten de werklieden bij u binnen zijn. Van u verwachten we dat u van tevoren de plekken vrij maakt waar gewerkt wordt, zodat er geen spullen in de weg staan.
Bij het vervangen van de kozijnen staat het aangrenzende vertrek in directe verbinding met buiten. Per gevel hebben we één dag nodig om de kozijnen te vervangen.

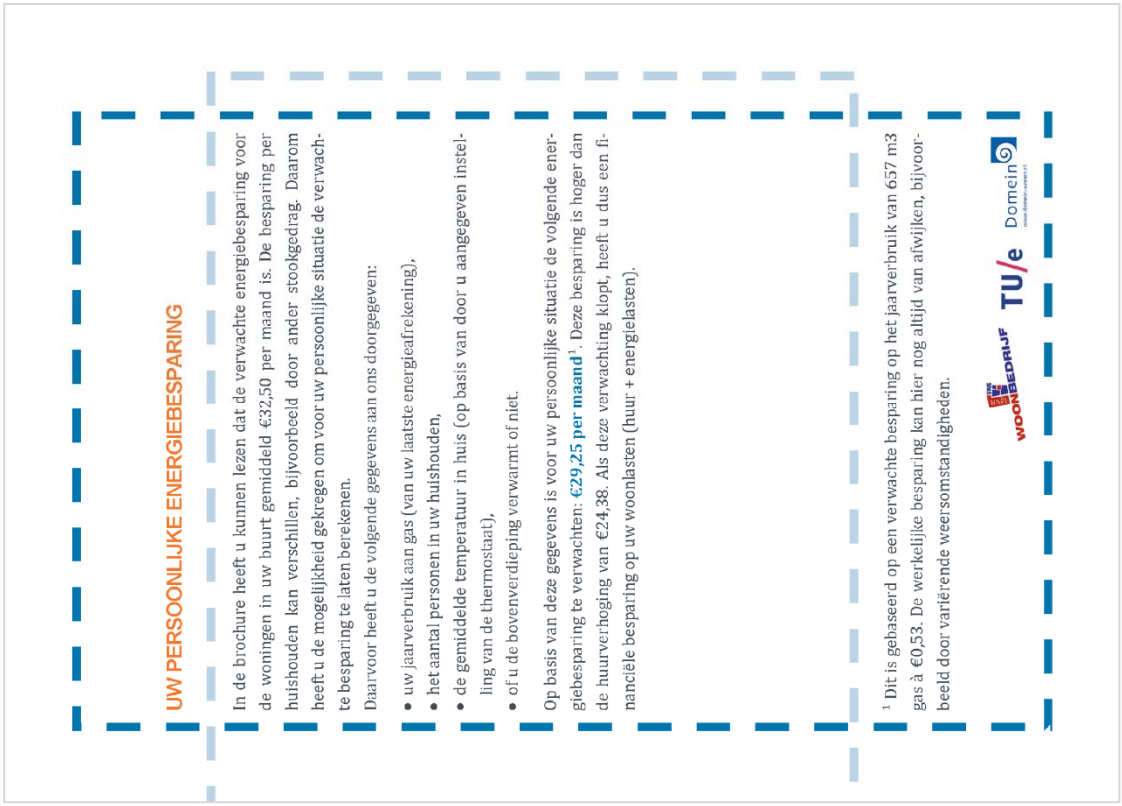
Even wennen

Na de werkzaamheden moet u wellicht even wennen aan de nieuwe situatie. Het nieuwe ventilatiesysteem zorgt voor andere luchtstromingen in huis. Misschien moet u opnieuw uitvinden hoe u uw thermostaat het beste in kunt stellen. Als u het op prijs stelt, kunt u ons hierbij om advies vragen.

Appendix B – Supplementary sheets

Three different supplementary sheets are used in the experiment. They are inserted in the brochures that are depicted in Appendix A – Brochures. One of the supplementary sheets presents an individualized calculation of the expected energy saving. Another provides a web address where additional information can be found. The third sheet contains both the calculation and the web address. Below, the three sheets are included. The contents of the webpage are provided in Appendix C.

Supplementary sheet with individualized calculation



UW PERSOONLIJKE ENERGIEBESPARING

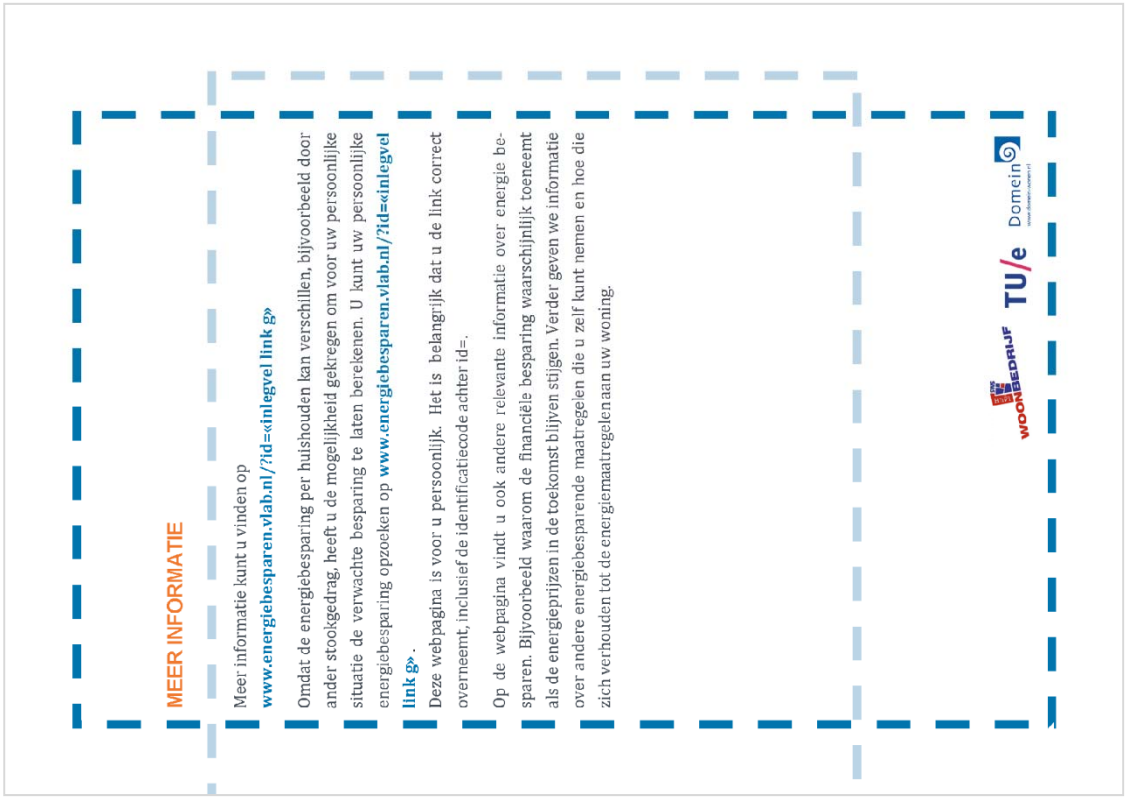
In de brochure heeft u kunnen lezen dat de verwachte energiebesparing voor de woningen in uw buurt gemiddeld €32,50 per maand is. De besparing per huishouden kan verschillen, bijvoorbeeld door ander stookgedrag. Daarom heeft u de mogelijkheid gekregen om voor uw persoonlijke situatie de verwachte besparing te laten berekenen.
Daarvoor heeft u de volgende gegevens aan ons doorgegeven:

- uw jaarverbruik aan gas (van uw laatste energieafrekening),
- het aantal personen in uw huishouden,
- de gemiddelde temperatuur in huis (op basis van door u aangegeven instelling van de thermostaat),
- of u de bovenverdieping verwarmt of niet.

Op basis van deze gegevens is voor uw persoonlijke situatie de volgende energiebesparing te verwachten: **€29,25 per maand**[1]. Deze besparing is hoger dan de huurverhoging van €24,38. Als deze verwachting klopt, heeft u dus een financiële besparing op uw woonlasten (huur + energielasten).

[1] Dit is gebaseerd op een verwachte besparing op het jaarverbruik van 657 m3 gas à €0,53. De werkelijke besparing kan hier nog altijd van afwijken, bijvoorbeeld door variërende weersomstandigheden.

Supplementary sheet with link to web page



MEER INFORMATIE

Meer informatie kunt u vinden op
www.energiebesparen.vlab.nl/?id=«inlegvel link g»

Omdat de energiebesparing per huishouden kan verschillen, bijvoorbeeld door ander stookgedrag, heeft u de mogelijkheid gekregen om voor uw persoonlijke situatie de verwachte besparing te laten berekenen. U kunt uw persoonlijke energiebesparing opzoeken op **www.energiebesparen.vlab.nl/?id=«inlegvel link g»** .

Deze webpagina is voor u persoonlijk. Het is belangrijk dat u de link correct overneemt, inclusief de identificatiecode achter id=.

Op de webpagina vindt u ook andere relevante informatie over energie besparen. Bijvoorbeeld waarom de financiële besparing waarschijnlijk toeneemt als de energieprijzen in de toekomst blijven stijgen. Verder geven we informatie over andere energiebesparende maatregelen die u zelf kunt nemen en hoe die zich verhouden tot de energiemaatregelen aan uw woning.

WOONBEDRIJF TU/e Domein

Supplementary sheet with individualized calculation and link to webpage

UW PERSOONLIJKE ENERGIEBESPARING

In de brochure heeft u kunnen lezen dat de verwachte energiebesparing voor de woningen in uw buurt gemiddeld €32,50 per maand is. De besparing per huishouden kan verschillen, bijvoorbeeld door ander stookgedrag. Daarom heeft u de mogelijkheid gekregen om voor uw persoonlijke situatie de verwachte besparing te laten berekenen.

Daarvoor heeft u de volgende gegevens aan ons doorgegeven:

- uw jaarverbruik aan gas (van uw laatste energieafrekening),
- het aantal personen in uw huishouden,
- de gemiddelde temperatuur in huis (op basis van door u aangegeven instelling van de thermostaat),
- of u de bovenverdieping verwarmt of niet.

Op basis van deze gegevens is voor uw persoonlijke situatie de volgende energiebesparing te verwachten: **€29,25 per maand**[1]. Deze besparing is hoger dan de huurverhoging van €24,38. Als deze verwachting klopt, heeft u dus een financiële besparing op uw woonlasten (huur + energielasten).

MEER INFORMATIE

Meer informatie kunt u vinden op
www.energiebesparen.vlab.nl/?id=«inlegvel indiv+link h»

Op de webpagina vindt u meer relevante informatie over energie besparen. Bijvoorbeeld waarom de financiële besparing waarschijnlijk toeneemt als de energieprijzen in de toekomst blijven stijgen. Verder geven we informatie over andere energiebesparende maatregelen die u zelf kunt nemen en hoe die zich verhouden tot de energiemaatregelen aan uw woning.

Deze webpagina is voor u persoonlijk. Het is belangrijk dat u de link correct overneemt, inclusief de identificatiecode achter id=.

[1] Dit is gebaseerd op een verwachte besparing op het jaarverbruik van 657 m3 gas à €0,53. De werkelijke besparing kan hier nog altijd van afwijken, bijvoorbeeld door variërende weersomstandigheden.

WOONBEDRIJF TU/e Domein

Appendix C – Webpage

On a supplementary sheet in the brochure, part of the subjects received a personal web address where they could look up additional information. The text of the supplementary sheet is given in Appendix B. The id in the web address allowed for individual registration of watching behavior. To avoid that people used the wrong id by accident (e.g. due to a typing error), the introductory page asked for the four numbers of one's zip-code.

On the main page a menu is found with three buttons. When hovering over a button with the mouse cursor, the according text appears. When the cursor is moved away, the text disappears. The time that each text is visible is logged. The texts are provided below.

Individualized calculation of expected energy saving

This text is equal to the text provided on the supplementary sheets. See Appendix B.

Explanation of future advantage

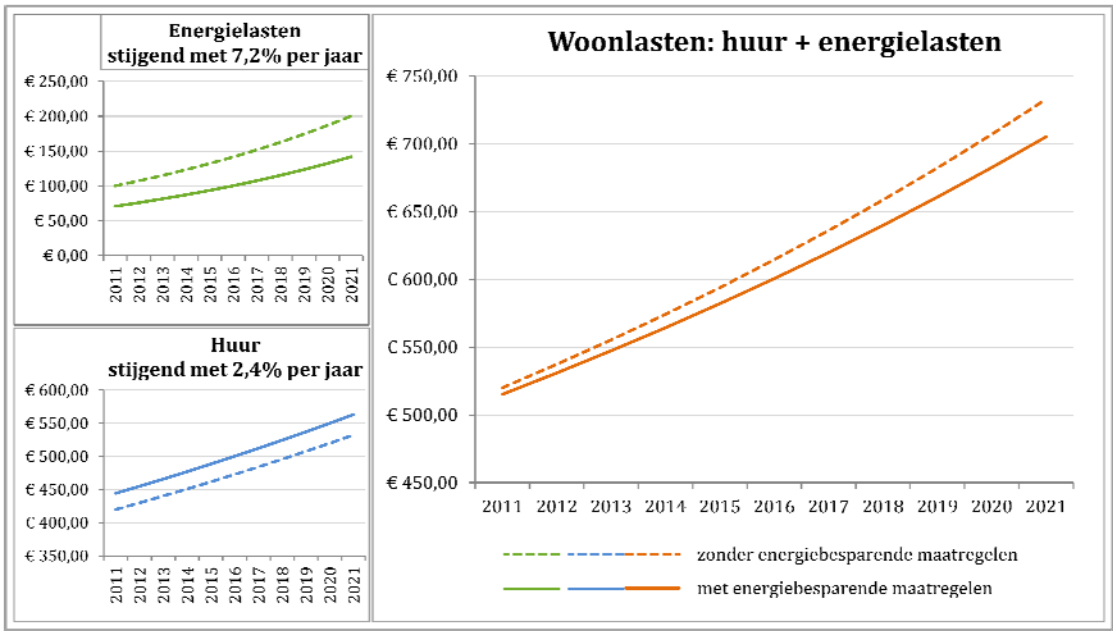
Uw besparing in de toekomst

Naar verwachting stijgt de gasprijs sterker dan de huur. Met de energiebesparende maatregelen stijgen uw woonlasten (huur + energielasten) daarom waarschijnlijk minder dan zonder de energiemaatregelen.

De grafieken hieronder laten zien hoe de kosten stijgen als dat even snel gaat als de afgelopen tien jaar. In de periode van 2000 tot 2010 steeg de gasprijs in Nederland jaarlijks gemiddeld met 7,2%. De huren stegen in dezelfde periode veel minder snel: gemiddeld met 2,4%. (Bron: CBS)

De grafieken tonen de kostenstijging met en zonder de energiemaatregelen. In de grafiek linksboven ziet u de stijging van de energielasten. De lijnen liggen in 2021 verder uit elkaar dan in 2011. De grafiek linksonder toont de stijging van de huur. Door het lagere stijgingspercentage lopen deze lijnen nauwelijks verder uit elkaar. De rechter grafiek toont de optelsom van de energielasten en de huur: de woonlasten. Doordat de huurverhoging lager is dan de verwachte energiebesparing, zijn de woonlasten met de energiemaatregelen lager dan zonder. De lijnen liggen in 2011 nog dicht bij elkaar. In 2021 liggen ze verder uit elkaar. Uw financiële besparing neemt dus toe.

Het is niet zeker met welke percentages de huur en de gasprijs de komende jaren stijgen. De stijging is niet elk jaar gelijk, dus uw werkelijke besparing zal afwijken van de grafiek. Maar zolang de gasprijs sterker stijgt dan de huur, neemt de financiële besparing van de energiebesparende maatregelen over de tijd toe.



Comparison with other energy-saving measures

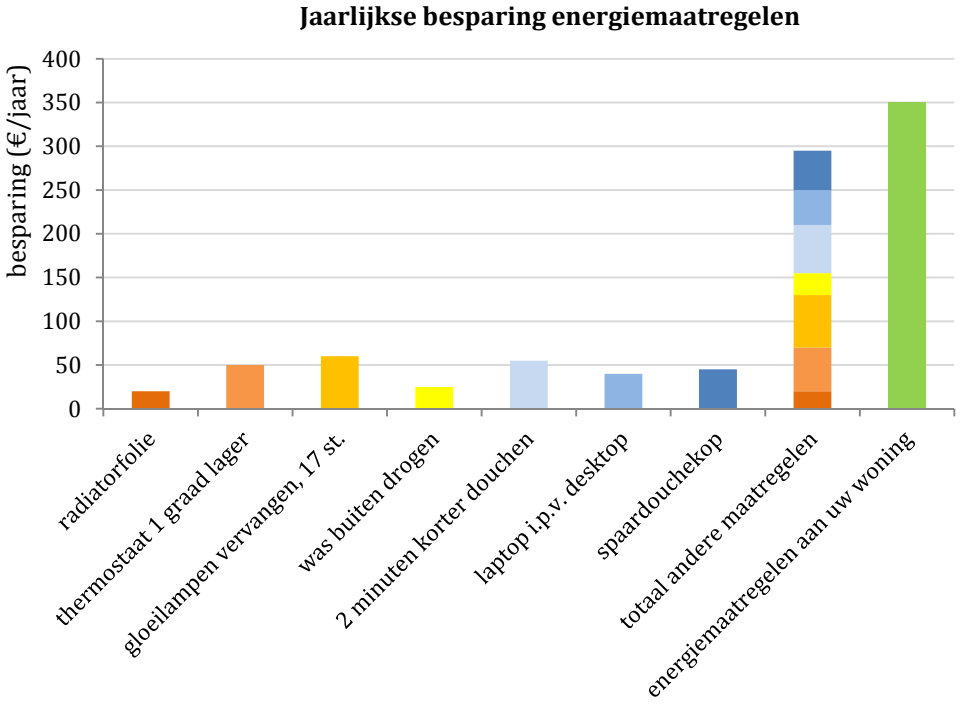
Andere energiebesparende maatregelen

Het isoleren van uw woning is een erg effectieve manier om energie te besparen. In het kader hieronder vindt u andere manieren om energie te besparen en wat die opleveren.[16]0020De grafiek onderaan laat zien dat de energiemaatregelen aan uw woning meer opleveren dan de energiebesparingen uit het kader bij elkaar opgeteld. Het isoleren levert dus veel energiebesparing op.

De energiemaatregelen vragen wel een flinke investering. Daarom vragen we er een huurverhoging voor. De maatregelen in het kader kunt u zelf uitvoeren. Sommige vragen een geringe investering; enkele zijn ook gratis.

- Breng radiatorfolie achter de verwarming aan om warmteverlies te voorkomen.
  U bespaart €20,- per jaar (37 m^3/jaar) en beperkt de uitstoot van CO_2 met 70 kg/jaar.
- Trek een warme trui aan en zet de thermostaat voortaan één graad lager.
  U bespaart zo'n €50,- per jaar (93 m^3/jaar) en beperkt de CO_2-uitstoot met 170 kg/jaar.
- Vervang alle gloeilampen in huis door energiezuinige lampen. In een gemiddeld huishouden zijn dat 17 lampen.
  U bespaart dan €60,- per jaar (273 kWh/jaar) en vermindert de CO_2-uitstoot met 150 kg/jaar. Per gloeilamp is dat €3,53/jaar (16 kWh/jaar) en 8,8 kg CO_2/jaar.
- Hang uw was buiten op de lijn te drogen in plaats van een wasdroger te gebruiken.
  U bespaart €25,- per jaar (114 kWh/jaar). De CO_2-uitstoot is dan 60 kg/jaar minder.
- Douche bij elke douchebeurt twee minuten korter dan u gewend bent.
  Zo bespaart u €55,- per jaar (102 m3/jaar) en beperkt de CO_2-uitstoot met 160 kg/jaar.
- Gebruik een laptop in plaats van een desktop computer.
  U bespaart €40,- per jaar (182 kWh/jaar). U beperkt de CO_2-uitstoot met 90 kg/jaar.
- Vervang een gewone douchekop door een spaardouchekop.
  Dat bespaart u €45,- per jaar (83 m3/jaar) en scheelt 140 kg CO_2/jaar

[16] De besparingen gelden voor een gemiddeld huishouden in Nederland. Bron: MilieuCentraal


Jaarlijkse besparing energiemaatregelen
besparing (€/jaar)
400
350
300
250
200
150
100
50
0
radiatorfolie
thermostaat 1 graad lager
gloeilampen vervangen, 17 st.
was buiten drogen
2 minuten korter douchen
laptop i.p.v. desktop
spaardouchekop
totaal andere maatregelen
energiemaatregelen aan uw woning

Appendix D – Questionnaire

There are four versions of the questionnaire that respondents received with the information material. They vary according to the different materials they received. All four contain questions about the brochure. People that receive an inlay in the brochure (conditions B and F, see Figure 6.1) get a version that also asks about the individualized calculation on the supplementary sheet. The version for the persons that receive a link to the webpage (conditions C and G) contains questions about the information on that webpage. People that receive an inlay with both the calculation and the link to the webpage (conditions D and H) get the version that contains all those questions.

The last and longest version is provided hereafter. The questions that were omitted in the other versions are listed in the text box below.

Version	Conditions	Materials	Questions omitted
1	A & E	Brochure	3, 4, 5, 6def, 7def, 8def, 10, 11
2	B & F	Brochure + inlay with individualized calculation	5, 6ef, 7ef, 8ef, 11
3	C & G	Brochure + link to webpage	3, 4, 10

Lees a.u.b. deze toelichting voordat u met het onderzoek begint!

Toelichting vragenlijst

Ik wil u vragen om de voorbeeldbrochure en de aanvullende informatie te bekijken en daarna de vragenlijst in te vullen. Het webadres op het inlegvel verwijst naar een echte webpagina. Als u in de gelegenheid bent, kunt u deze dus bekijken. Als dat niet kan, kunt u de vragenlijst toch invullen en de vragen over de webpagina overslaan.
Wij vragen u om bij het lezen van de informatie ervan uit te gaan dat die voor u persoonlijk is bedoeld. Ga ervan uit dat u in een rijwoning woont, waarvan de keuken, de badkamer en het toilet aan de beurt zijn voor onderhoud. Verder is het huis matig geïsoleerd en heeft u geen mechanische ventilatie. Lees de informatie met dezelfde aandacht en op dezelfde manier als u zou doen, wanneer het echt om uw woning zou gaan. Dit geldt zowel voor de voorbeeldbrochure, als voor het inlegvel en de webpagina.
Na het lezen van de informatie kunt u de vragenlijst invullen. Volgt u bij het invullen a.u.b. de onderstaande instructies.

Bij een aantal vragen moet u op een schaal aangeven wat u vindt. Dat kan er bijvoorbeeld zo uitzien:

1. Hoe leuk of saai vindt u deze enquête? Geef op de schaal aan wat u vindt.

Erg leuk				Erg saai
O	O	O	O	O

Er zijn vijf antwoorden mogelijk. De uitersten zijn aangegeven: erg leuk en erg saai. Vindt u de enquête erg leuk of erg saai, kleur dan het meest linkse of meest rechtse bolletje in. Vindt u iets ertussenin, kleur dan één van de tussenliggende bolletjes in, waarbij verder naar rechts saaier en verder naar links leuker betekent.

Omdat de vragenlijst automatisch wordt verwerkt, is het belangrijk dat u deze op de juiste manier invult. De verschillende keuzemogelijkheden zijn aangeven met een bolletje (O).
Kleur het bij uw antwoord behorende bolletje duidelijk in.

Goed: ● of ● Fout: ⊗

Vul per vraag één antwoord in, tenzij bij de vraag vermeld staat dat meerdere antwoorden mogelijk zijn.
Als u uw antwoord wil corrigeren, zet dan duidelijk een kruis door het verkeerde antwoord (⊗) en geef duidelijk uw verbetering aan met een pijl (●←)

Vragenlijst

Over de brochure en de webpagina

Als u de instructies op het voorblad heeft gevolgd, heeft u de bijgevoegde voorbeeld-brochure met inlegvel bekeken. Hieronder vindt u enkele vragen over hoe aandachtig u de informatie heeft gelezen en over wat u van de informatie vindt.

1. Hoe oppervlakkig of aandachtig heeft u de onderstaande informatie uit de brochure bekeken?

	Oppervlakkig bekeken				Aandachtig bestudeerd
Inleiding (pag.3)	O	O	O	O	O
Onderhoud aan keuken, toilet en badkamer (pag.4)	O	O	O	O	O
Energiebesparende maatregelen: werkzaamheden (pag.5)	O	O	O	O	O
Energiebesparende maatregelen: wat betekenen de energie-maatregelen voor u? (pag.6,7)	O	O	O	O	O

2. Als u de brochure in het algemeen moet beoordelen, welk rapportcijfer (van 0 tot 10) zou u dan geven? _____

3. In de brochure zat een inlegvel met uw persoonlijke energiebesparing. Hoe oppervlakkig of aandachtig heeft u het inlegvel bekeken?

	Oppervlakkig bekeken				Aandachtig bestudeerd
Inlegvel	O	O	O	O	O

4. Als u het inlegvel in het algemeen moet beoordelen, welk rapportcijfer (van 0 tot 10) zou u dan geven? _____

5. Op het inlegvel in de brochure staat een link naar een webpagina met meer informatie. Heeft u de webpagina bekeken?
   O Ja (ga naar a.)
   O Nee (ga naar c.)

   a. Als ja: hoe oppervlakkig of aandachtig heeft u de de webpagina bekeken?

	Oppervlakkig bekeken				Aandachtig bestudeerd
Webpagina	O	O	O	O	O

   b. Als u de brochure in het algemeen moet beoordelen, welk rapportcijfer (van 0 tot 10) zou u dan geven? _____

c. Als nee: waarom heeft u de webpagina niet bekeken?
   O Ik maak geen gebruik van internet.
   O Ik heb er geen tijd voor.
   O Ik heb geen interesse.
   O Ik heb een andere reden, namelijk: _____

6. Vindt u de hoeveelheid informatie over de onderstaande onderwerpen teveel, te weinig of goed? Geef op de schaal aan wat u vindt. (Als u de webpagina niet heeft bekeken, vult u niet van toepassing ('n.v.t.') in.)

	Te weinig		Precies goed		Teveel	n.v.t
Brochure						
De onderhoudswerkzaamheden	O	O	O	O	O	
De werkzaamheden voor de energiebesparende maatregelen	O	O	O	O	O	
Wat de energiemaatregelen voor u betekenen	O	O	O	O	O	
Inlegvel						
Uw persoonlijke energiebesparing	O	O	O	O	O	
Webpagina						
Uw besparing in de toekomst	O	O	O	O	O	O
Andere energiebesparende maatregelen	O	O	O	O	O	O

7. Hoe duidelijk of onduidelijk vindt u de informatie over de onderstaande onderwerpen? Geef op de schaal aan wat u vindt. (Als u de webpagina niet heeft bekeken, vult u niet van toepassing ('n.v.t.') in.)

	Erg duidelijk				Erg onduidelijk	n.v.t
Brochure						
De onderhoudswerkzaamheden	O	O	O	O	O	
De werkzaamheden voor de energiebesparende maatregelen	O	O	O	O	O	
Wat de energiemaatregelen voor u betekenen	O	O	O	O	O	
Inlegvel						
Uw persoonlijke energiebesparing	O	O	O	O	O	
Webpagina						
Uw besparing in de toekomst	O	O	O	O	O	O
Andere energiebesparende maatregelen	O	O	O	O	O	O

8. Hoe nuttig vindt u de informatie over de onderstaande onderwerpen? Geef op de schaal aan wat u vindt. (Als u de webpagina niet heeft bekeken, vult u niet van toepassing ('n.v.t.') in.)

	Informatie niet nuttig			Informatie erg nuttig		n.v.t
Brochure						
De onderhoudswerkzaamheden	O	O	O	O	O	
De werkzaamheden voor de energiebesparende maatregelen	O	O	O	O	O	
Wat de energiemaatregelen voor u betekenen	O	O	O	O	O	
Inlegvel						
Uw persoonlijke energiebesparing	O	O	O	O	O	
Webpagina						
Uw besparing in de toekomst	O	O	O	O	O	O
Andere energiebesparende maatregelen	O	O	O	O	O	O

9. Mist u informatie in de brochure?
   O ja, namelijk: _____
   O nee
10. Mist u informatie op het inlegvel?
   O ja, namelijk: _____
   O nee
11. Mist u informatie op de website?
   O ja, namelijk: _____
   O nee

Uitvoering werkzaamheden

Als uw woningcorporatie werkzaamheden aan uw woning uitvoert, is daar in bepaalde gevallen eerst uw toestemming voor nodig. In de voorbeeldbrochure staat dat dit voor de genoemde werkzaamheden het geval is.

12. Zou u, na het lezen van de informatie, de volgende werkzaamheden wel of niet laten uitvoeren? (Ga ervan uit dat uw keuken, toilet en badkamer zo oud zijn als in de brochure vermeld staat en u deze dus niet tussentijds heeft vervangen.)

	Zeker wel	Waarschijnlijk wel	Eerder wel dan niet	Eerder niet dan wel	Waarschijnlijk niet	Zeker niet
Onderhoud aan de keuken	O	O	O	O	O	O
Onderhoud aan het toilet	O	O	O	O	O	O
Onderhoud aan de badkamer	O	O	O	O	O	O
Energiebesparende maatregelen	O	O	O	O	O	O

13. Welke van de onderstaande argumenten spelen voor u een rol bij uw keuze om de werkzaamheden wel of niet uit te laten voeren? (meerdere antwoorden mogelijk)
    Omdat er bij zo'n keuze altijd voor- en nadelen zijn, kunnen er voor u ook in dit geval zowel voor- als nadelen relevant zijn.
    a. **Onderhoud aan de keuken**
        - O Nieuw materiaal is beter dan het oude
        - O Ongemak tijdens de werkzaamheden
        - O Kan zelf kleuren e.d. kiezen
        - O Moeten wennen aan nieuwe keuken
        - O Anders, nl.: _____
    b. **Onderhoud aan het toilet**
        - O Nieuw materiaal is beter dan het oude
        - O Ongemak tijdens de werkzaamheden
        - O Kan zelf kleuren e.d. kiezen
        - O Moeten wennen aan nieuwe keuken
        - O Anders, nl.: _____
    c. **Onderhoud aan de badkamer**
        - O Nieuw materiaal is beter dan het oude
        - O Ongemak tijdens de werkzaamheden
        - O Kan zelf kleuren e.d. kiezen
        - O Moeten wennen aan nieuwe keuken
        - O Anders, nl.: _____
    d. **Energiebesparende maatregelen**
        - O Besparing op stookkosten
        - O Huurverhoging
        - O Goed voor het milieu
        - O Verbetering comfort
        - O Ongemak tijdens de werkzaamheden
        - O Betere luchtkwaliteit
        - O Moeten wennen aan nieuwe situatie
        - O Anders, nl.: _____

14. Hieronder staan enkele stellingen over de gevolgen van het onderhoud en de energiebesparende maatregelen. Hoe zeker bent u ervan dat deze waar of onwaar zijn?

	Zeker niet waar		Onzeker		Zeker waar
Ik ga er financieel op vooruit.	O	O	O	O	O
Ik heb tijdelijk overlast van de werkzaamheden.	O	O	O	O	O
Mijn nieuwe keuken is beter dan de huidige.	O	O	O	O	O
Ik spaar het milieu.	O	O	O	O	O
De luchtkwaliteit in huis verbetert.	O	O	O	O	O
Mijn nieuwe badkamer is beter dan de huidige.	O	O	O	O	O
Ik ga er financieel op achteruit.	O	O	O	O	O
De energiemaatregelen besparen meer dan veel andere manieren van energie besparen.	O	O	O	O	O
Het is aangenaam warm in huis.	O	O	O	O	O
Ik moet even wennen aan de nieuwe situatie.	O	O	O	O	O
In de toekomst neemt het financiële voordeel van de energiebesparing toe.	O	O	O	O	O
Ik verbruik minder energie dan voorheen.	O	O	O	O	O
Mijn nieuwe toilet is beter dan het huidige.	O	O	O	O	O

Vragen over u en uw woning

15. Wat is uw geslacht?
    O Man
    O Vrouw

16. Met hoeveel mensen woont u op dit adres (inclusief uzelf)?

    ____

17. Wat is uw leeftijd?

    ____

18. Wat is/zijn de leeftijd(en) van de ander(en) die op dit adres woont/wonen?

    _____
    O niet van toepassing, ik woon alleen

19. Wat is het bruto jaarinkomen van uw huishouden?
    O Minder dan €20.000,-
    O €20.000,- tot €40.000,- (modaal inkomen per persoon = €32.500,-)
    O €40.000,- tot €60.000,-
    O €60.000,- tot €80.000,- (2 x modaal = €65.000,-)
    O Meer dan €80.000,-

20. Hoeveel doet u om energie te besparen, als u uzelf vergelijkt met anderen?

meer		evenveel		minder
O	O	O	O	O

21. Hoe betrokken voelt u zich bij het milieu, als u uzelf vergelijkt met anderen?

meer betrokken		even betrokken		minder betrokken
O	O	O	O	O

22. Is er de afgelopen 2 jaar onderhoud aan uw woning gepleegd door uw woningcorporatie?

    O Ja (ga naar a.)
    O Nee
    a. Als ja: wat is er gedaan? _____

_____

* Het bruto inkomen bestaat uit inkomen uit arbeid, inkomen uit eigen onderneming en inkomen uit vermogen, plus uitkeringen (zoals WW, WAO, AOW of bijstand), tegemoetkoming studiekosten, toeslagen van de belastingdienst en alimentatie.

Summary

SUPPORTING TENANTS' DECISIONS ON ENERGY-SAVING MEASURES
How housing corporations can propose work

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ABSTRACT
Housing corporations experience reluctance in tenants to accept energy-saving measures, even when the expected financial outcomes are positive for the tenant. Possibilities to improve the presentation of the proposed energy measures are looked for. Previous research in decision-making suggests that advantages of the measures can be made more prominent to nudge tenants to participate. Also, supplying extra information is suggested; to broaden the scope towards the future gains and towards other energy measures, paid from another mental budget. Interviews with tenants suggest yet another possible improvement; supplying an individualized calculation of the energy saving to reduce tenants' uncertainty of the outcomes. The suggested improvements are actualized in information materials and tested in an experiment.

Keywords: decision making, existing social housing, housing corporations, tenants, energy-saving measures

INTRODUCTION
Energy-saving measures in rental houses contribute to the solution of climate problems as well as (anticipated) problems with living expenses. Housing corporations are in a good position to make a contribution in solving these problems. Taking energy-saving measures involves substantial investment costs that can (partly) be passed on to the tenants by means of a rent increase. When deciding whether to accept energy measures proposed by their corporation, tenants have to trade off the benefits of reduced energy costs and increased comfort of living against the costs of the rent increase and the temporary discomfort during renovations.
Housing corporations experience that tenants are reluctant to give their consent, even when the benefits outweigh the costs (Aedes, 2010). This reluctance indicates suboptimal choice behavior. Decision-making research aims at explaining such suboptimal choices. The present research investigates which explanations may hold for the suboptimal choice of (some) tenants.

Aim of the research
The aim of this research is to investigate what factors influence the decisions of tenants to accept or reject rent-increasing energy-saving measures, and to recommend how this knowledge can be used to help tenants make more well-informed decisions.

Research questions
The research aim can be broken down into the following research questions:
- What factors influence the decisions of tenants to accept or reject rent-increasing energy-saving measures?
- How can tenants be helped to make well-informed decisions?
- Do the suggestions to help tenants make well-informed decisions work in practice?

It is assumed that the corporation's proposal has a positive outcome for the tenants. Then, the optimal choice after weighing up the advantages and disadvantages is to accept the energy-saving measures. The opportunity to reject should always remain, because exceptions can occur that render the acceptance of the measures suboptimal in specific cases.

This research addresses both a practical societal problem and a scientifically relevant decision- making issue. A translation is made from theory to practice by proposing an intervention to help people make well-informed decisions.
The research is conducted in Eindhoven at two housing corporations, Domein and Woonbedrijf. Although the outcome of this research is of interest for those corporations, the focus is broader and results apply to tenants of other corporations too.

Outline of summary
The following steps are taken to answer the abovementioned questions. After a broad outline of the socio-technical background of the research problem, an overview of relevant decision-making theory is provided. To complement the results from literature research, information from practice is gathered through interviews with tenants and a review of current brochures. Several suggestions are given, comprising the enhanced, more prominent presentation of the advantages of the energy-saving measures, the individualization of the expected energy saving, and a focus-broadening elaboration of some specific advantages. The suggestions are actualized in informational brochures, inserts and a webpage and tested in an experiment. The hypotheses that are tested in the experiment are presented. The experiment is described and the results are discussed. Recommendations are given both for further research and for practical application of the research findings by housing corporations.

SOCIO-TECHNICAL BACKGROUND
Policy and instruments to stimulate improvement of the energy performance of houses have developed over the last decennia. When we look at the actors involved and their relation-ships, it appears that most stakeholders are involved in these developments.

The instruments mainly originate from the governmental actors. Negotiation takes place between them and the housing corporations at regional level and with the interest groups Aedes and the Woonbond at the national level. Housing corporations, contractors and suppliers are furthermore affected by subsidies. Tenants however, are less affected. They will be addressed through the provision of energy labels in the advertisements for vacant dwellings. However, this does not affect sitting tenants.
In other words, housing corporations seem to be addressed more directly and have a more active role than tenants. This is reflected in the intentions that many corporations show to take energy-saving measures, and the reluctance to participate that they encounter in some tenants.
Therefore, the tenant's decision whether to participate in energy-saving measures or not is an interesting subject to investigate. This individual decision of the tenant is investigated here, and not the influence of other actors, e.g. discussions with relatives and neighbors. The research results in recommendations for housing corporations on the communication toward their tenants about the proposed energy-saving measures.

SUGGESTIONS TO SUPPORT TENANTS' DECISIONS

In answer to the first research question, several factors that influence tenants' decisions are identified from decision-making theory and from interviews with tenants who recently had to decide on energy-saving measures. From the influencing factors, suggestions are derived that will help tenants in their decision. These provide an answer to the second research question.

Suboptimal decision making and nudging

People do not have a ready answer to such decisions as whether to accept or reject rent-increasing energy-saving measures. Rather, they construct their preferences during the process of thinking about choice. This process is not always the same as it is influenced by the way a question is put or the context in which a decision is made. Different thinking processes can lead to different preferences and consequently to different choices, while the available options stay the same. In this way, people can easily make choices that are not optimal for them.
However, this also offers the opportunity to set up a decision in such a way that people are more inclined to choose the optimal solution. Thaler and Sunstein (2009) propose to nudge peoples' choices in a certain direction in such a way. They reason that since it cannot be avoided that people are influenced by the way a choice situation is arranged, purposely or not, it is to be favored that such choice situations are designed conscientiously. They propose to "… help people make better choices (as judged by themselves) without forcing certain outcomes upon anyone…" (Thaler, Sunstein & Balz, n.d., p.1).

Suggestions from decision-making theory

Based on decision making theory several factors that influence tenants decisions on energy-saving measures can be pointed out. One is the order of presentation of advantages and disadvantages. By first reading the advantages and then the disadvantages, a preference for the energy measures develops more readily. Another influencing factor is the default option. People choose an option more often if it is the default than if it is not.

Another factor is people's focus on the present. Because of this, they will easily overlook that the advantage increases in the future, as energy prices increase more rapidly than rents. Moreover, when this is brought into focus, people cannot be expected to understand the exponential growth of the advantage directly. Exponential growth is not understood intuitively; cognitive reflection is needed.
A last influencing factor that decision making theory points out is the focus on the proposed measures. By comparing them with other energy-saving measures a broader mental budget is addressed. Tenants will then more readily accept the rent increase. Also, the evaluability of the energy saving is increased, because it can now be compared with that of the other measures. It becomes clear that the proposed measures are highly effective.

From interviews with tenants
A number of interviews with tenants, who recently had to make a decision about energy-saving measures, brought up another factor that was important in the decision of many. This was uncertainty over the outcomes. Moreover, the interviews showed that tenants do not know the cost of energy and have trouble judging the effectiveness of several energy measures. This suggests that providing additional information to reduce uncertainty can help tenants in their decision about proposed energy measures.

Review of current brochures
A review of current brochures that include energy-saving measures shows that the suggestions to support tenants' decisions are not or only partly applied yet. To find out if they work in practice, they are tested in an experiment.

EXPERIMENT: TESTING THE SUGGESTIONS
An experiment is conducted to test the hypotheses. 1400 tenants of Domein and Woonbedrijf are presented with a hypothetical proposal for maintenance work and energy-saving measures. These are presented in two different sample brochures that are sometimes supplemented with an individualized calculation on an inlay and/or a web address to look up additional information.

Hypotheses
The suggestions to help tenants make well-informed decisions are used as hypotheses to be tested in the experiment. The hypotheses are:

Hypothesis 1: Tenants are more inclined to choose for energy-saving measures if the advantages of those measures are presented more prominently.

Hypothesis 2: Tenants are more inclined to choose for energy-saving measures if they receive an individualized calculation of the expected energy saving.

Hypothesis 3: Tenants are more inclined to choose for energy-saving measures if they appreciate the future advantage of those measures better.

Hypothesis 4: Tenants are more inclined to choose for energy-saving measures that the housing corporation proposes if they compare them with other energy-saving measures that they can take themselves.

Method

The first hypothesis is actualized in the two brochure variants, a base brochure similar to current brochures and an alternative brochure with prominent advantages. In the alternative brochure, the advantages of the energy-saving measures are described before the disadvantages, they are described in more detail, and the execution of the work is presented as default.

The second hypothesis is tested using a supplementary sheet with an individualized calculation of the energy saving. This is one way of reducing uncertainty by providing individualized information. The outcome of the calculation is equal for all subjects. The text suggests to them that they already provided the information that is needed for the calculation earlier, and now are given the outcome.

The last two hypotheses are both actualized on a webpage where the additional information about future advantages and other energy-saving measures is provided. The time is measured that people watch each part of the information.

The two brochures, the supplementary sheet with an individualized calculation and the web page with additional information are combined into eight conditions. They are shown in the overview below (figure 1).

A questionnaire measures the willingness to accept the energy measures based on the received information material. It also measures potential covariates that contribute in the statistical analysis to find an effect of the conditions.

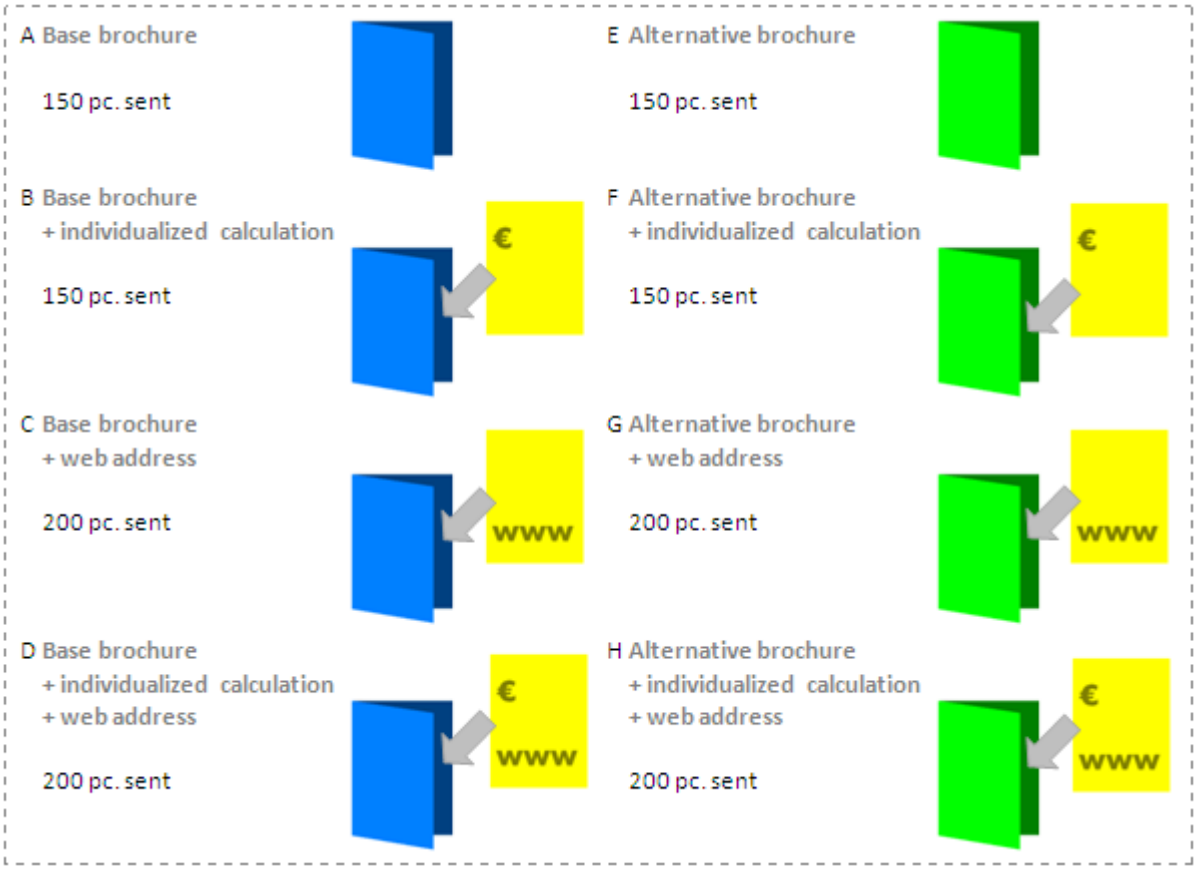

Figure 1: Overview of conditions

Results and discussion

About a quarter of the questionnaires are returned. More than half of the respondents (51.3%) say that they would certainly accept the energy-saving measures if these were proposed to them. Another third (35.6%) is not certain but still thinks they would accept. See figure 2.

This skewness of the distribution makes the dependent variable unsuitable for linear regression analysis. Therefore it is dichotomized so that logistic regression can be done. The certain accepters form one group; all others are combined into the other group.

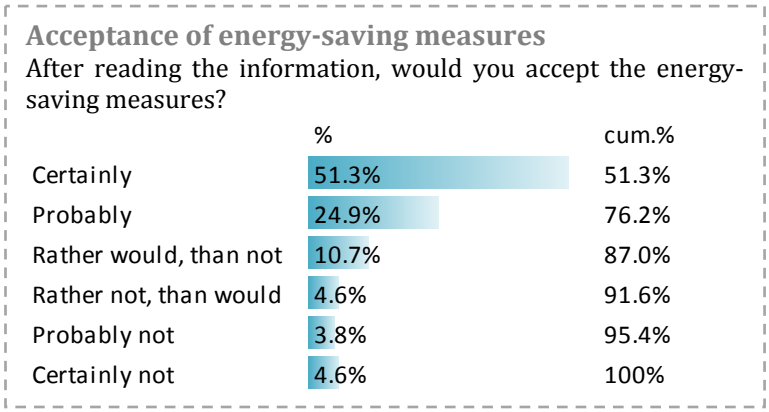

Figure 2: Distribution of acceptance of energy-saving measures

The webpage was viewed only 28 times. This is insufficient to do data analysis. Therefore, hypothesis 3 and 4 could not be tested.

Hypothesis 1 and 2 are tested in a regression analysis including both manipulations and their interaction. The alternative brochure and the individualized calculation by themselves do not have a significant effect on the acceptance of energy-saving measures.

The effect of the manipulations could be obscured by other variables that have an effect on acceptance. Therefore, the potential covariates that were measured in the questionnaire are included in the analysis.

Three covariates are found that have a significant effect on acceptance. The probability of acceptance is affected by household income, by the effort one takes to save energy and by the extent to which one feels environmentally engaged.

Tenants with a household income above €20,000 are more inclined to accept the energy measures. The alternative brochure does not change their acceptance rate. See figure 3. However, the alternative brochure has a substantial positive effect on tenants with lower household income. So the suggestions to describe the advantages first and to present the execution of the work as default are effective for this group. (NB This research does not demonstrate whether these manipulations also work separately.)

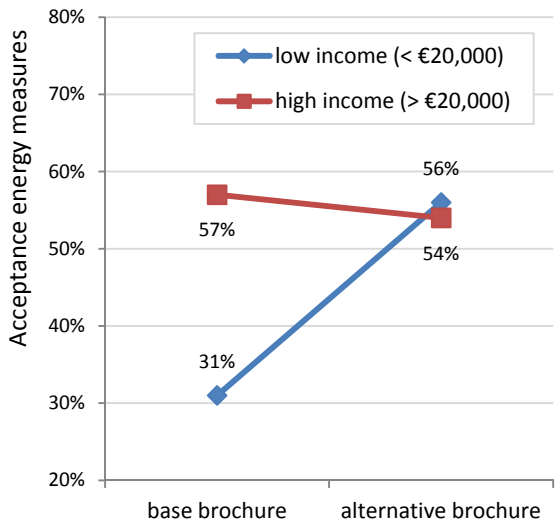

Figure 3: Effect of household income and brochure variant on acceptance

Tenants that take more effort to save energy than others and tenants that feel more engaged with the environment are more inclined to accept the proposed energy measures. When controlling for these covariates, a significant positive effect of the alternative brochure is again found. Furthermore, there is a significant interaction between the individualized calculation and being an energy-saver. This is shown in figure 4.

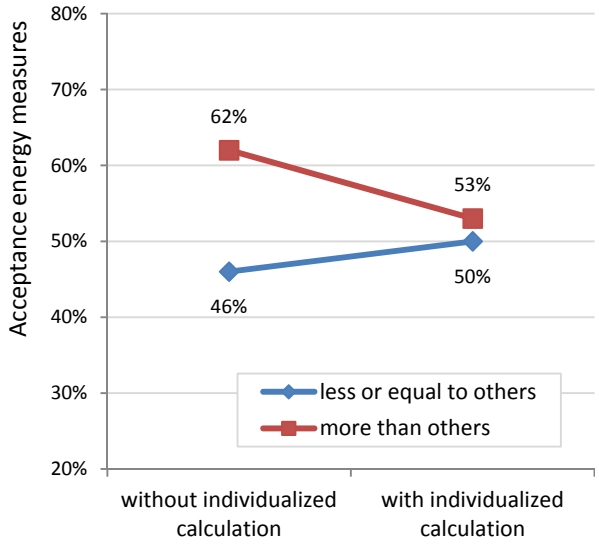

Figure 4: Effect of energy saving effort and individualized calculation on acceptance

The figure shows a negative effect of the individualized calculation for persons who take more effort to save energy. The effect for persons who take little effort to save energy, on the other hand, is positive.
To investigate the unexpected negative effect, a split is made between the respondents who received the base brochure and those who received the alternative brochure. The graph is then redrawn for both groups. This results in figure 5 and 6.

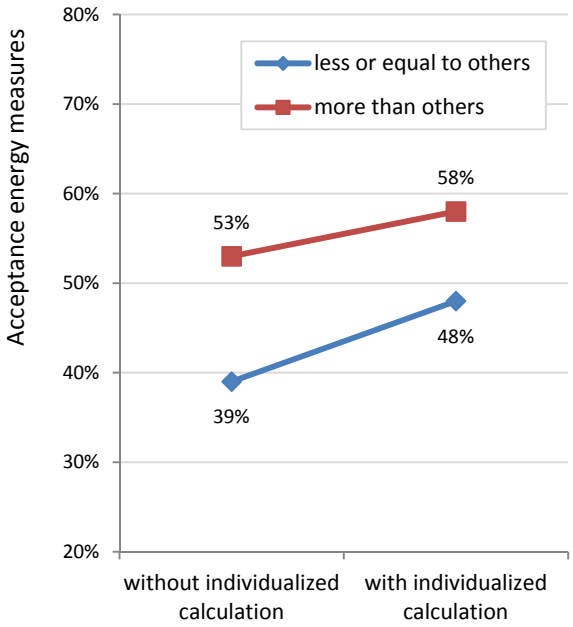

Figure 5: *Effect of energy saving effort and individualized calculation on acceptance* ***for respondents receiving base brochure***

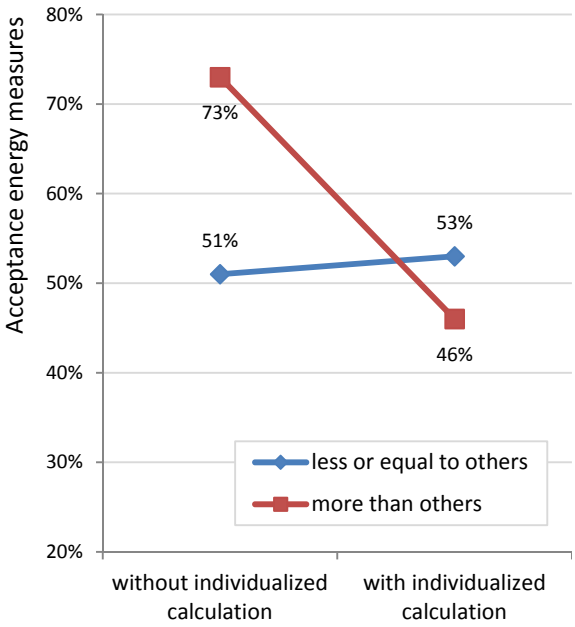

Figure 6: *Effect of energy saving effort and individualized calculation on acceptance* ***for respondents receiving alternative brochure***

These graphs show that the negative effect only occurs in the group of respondents that received both the alternative brochure and the individualized calculation. For all other respondents, the calculation has a small positive effect, which is marginally significant.
This result might be explained by the individual energy saving being lower than the average presented in the brochure. However, this cannot be tested in this research. Therefore, hypothesis 2 cannot be confirmed nor rejected at this point.

Conclusions

Hypothesis 1 is partly confirmed. Making the advantages more prominent increases the acceptance of low income households.
Hypothesis 2 is neither confirmed nor rejected. The individualized calculation has a negative effect on enthusiastic energy savers that received the alternative brochure, and a small positive effect on all others. The negative effect cannot be explained with certainty, but might be caused by disappointment. It is recommended to do further research into this.
Providing individualized information is suggested in the field as an opportunity to convince tenants. This could not be confirmed by this research. If the proposed explanation of the lower individual outcome is correct, this has consequences for the use of individualized information. After all, part of the tenants will always have lower results than average.
Further research is also advised for hypotheses 3 and 4. They could not be tested due to lack of data. The suggestions to broaden the scope to the future advantage and to other energy-saving measures are supported by decision making theory, and offer new opportunities that are not suggested in the field yet.

RECAP OF RESEARCH QUESTIONS AND ANSWERS

1. What factors influence the decisions of tenants to accept or reject rent-increasing energy-saving measures?
   - The order of advantages and disadvantages;
   - Which option is the default;
   - Focus on the present;
   - Focus on the proposed measures;
   - Uncertainty about the outcomes.
2. How can tenants be helped to make well-informed decisions?
   - Discuss advantages before disadvantages;
   - Present the realization of the energy measures as the default;
   - Bring into focus the future advantage and explain its exponential growth;
   - Compare the proposed measures with other energy-saving measures;
   - Provide additional information to reduce uncertainty.
3. Do the suggestions to help tenants make well-informed decisions work in practice?
   - The first two suggestions are bundled and have a substantial effect for tenants with a household income below €20,000. For higher income households, these suggestions have no effect, but they are more inclined to accept the measures already.
   - The two suggestions to broaden focus -to the future and to other energy measures- could not be tested.
   - The last suggestion, to reduce uncertainty with additional information, is tested by providing an individualized calculation of the energy saving. This had a marginal positive effect, except for tenants who received the improved brochure (in which the first two suggestions are realized) and who also indicated that they take more effort to save energy than others. For these people the individualized calculation had a substantial negative effect. The cause for this could be disappointment in the lower energy saving, but this is not certain. Therefore, it remains uncertain whether this suggestion works in practice.

RECOMMENDATIONS FOR HOUSING CORPORATIONS

- Make an offer that is beneficial for (most of) the tenants.
- In communication about the energy-saving measures, discuss the advantages before the disadvantages.
- Describe the execution of the work as the default option, not as an extra choice.
- Explain the increasing advantage in the future.
- Compare the proposed measures to other energy-saving measures that tenants can take themselves.
- Reduce uncertainty about the outcomes. This can be done in many ways, for example by providing individualized information, by means of a show house, or by exchanging experiences with other tenants. Be aware that more certainty can also lead to disappointment if the expectations are too high. So do not create too high expectations beforehand.

RECOMMENDATIONS FOR FURTHER RESEARCH

Further research is recommended into:

- the individual effects of the order of advantages and disadvantages and the presentation of the execution of work as the default option;
- the cause of the negative effect of the individualized calculation for a specific group of tenants that take much effort to save energy and that furthermore received the alternative brochure;
- the effectiveness of explaining the future advantage;
- the effectiveness of comparing the proposed measures to other energy-saving measures.

REFERENCES

Aedes. (2010, October 18). Zó raken bewoners enthousiast voor energiebesparing. *Aedes-Magazine, 19*. 16-19.

Thaler, R.H. & Sunstein, C.R. (2009). *Nudge: Improving Decisions about Health, Wealth and Happiness.* London: Penguin Books Ltd

Thaler, R.H., Sunstein, C.R., & Balz, J.P. (n.d.). Choice architecture. Retrieved from http://ssm.com/abstract=1583509

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Although many factors influence the decisions of tenants on accepting rent-increasing energy-saving measures, my research indicates that tenants may be nudged to accept a good proposal by means of well-informed choice architecture.

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