

# How to stimulate owner-occupiers to save energy?

Renée Bruel  
SenterNovem  
P.O. Box 8242  
3503 RE Utrecht  
The Netherlands

Joris Hoekstra  
OTB TU Delft  
P.O. Box 5030  
2600 GA Delft  
The Netherlands

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## Abstract

In order to meet the Dutch governmental goals of reducing CO<sub>2</sub> emission, strategies are needed to stimulate target groups to intensify efforts to save energy. SenterNovem, commissioned by the Ministry of Housing and Environment, developed a strategy to effectively influence the energy-relevant behaviour of owner-occupiers of residential buildings. This target group forms a large segment of the total group of households. This study addressed the following questions: (1) what are the determinants of energy-relevant behaviour of owner-occupiers of dwellings, (2) do different segments within that target group have different determinants of behaviour, and (3) what policy instruments are most effective in changing their behaviour?

From a survey of owner-occupiers 'predisposing' and 'enabling' determinants rather than 'reinforcing' determinants are most influential on the behaviour of owner-occupiers. Furthermore, we identified two segments within the target group: a low-income group and a high-income group. Low-income owner-occupiers are mainly influenced by predisposing determinants, Higher-income owner-occupiers are mainly influenced by enabling determinants,

An intervention strategy was then based on matching the determinants of the segments and the 'active ingredients' of policy instruments. The policy instruments most effective in changing the behaviour of the low-income group communicate the advantages of saving energy, offer information and provide subsidies or fiscal incentives. The policy instru-

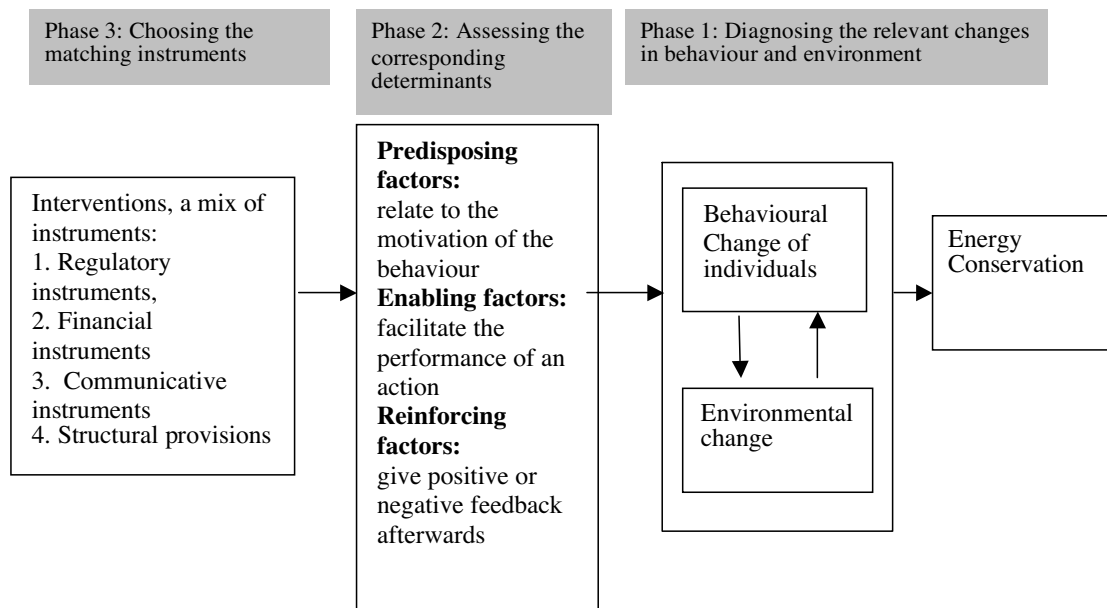
ments most effective in changing the behaviour of the high-income group give personal face-to-face or computer-based advice, appeals to housing comfort and the societal responsibility of the respondent, and focus on changing behaviour.

In this paper we lay the basis for an intervention strategy that will effectively influence the behaviour of owner-occupiers of older dwellings to invest in and use of energy-conservation technology. The results are relevant for governments and agencies that design energy conservation policies.

## Introduction

To meet the requirements of the Kyoto-Treaty, Dutch governmental policy aims to reduce energy consumption and thereby reduce the emission of CO<sub>2</sub>. In 2004 the Dutch Government established upper limits per sector for CO<sub>2</sub> emission for the year 2010. The limit for the Built Environment sector is 29 Mton CO<sub>2</sub>. To meet this sector limit the Dutch Ministry of Environmental Affairs commissioned SenterNovem to develop a strategy to change the behaviour of various target groups within this sector. In this paper we focus on the target group consisting of owner-occupiers of residential dwellings built before 1975.

Dutch governmental policy has focused on the development of energy conservation technology which, although very necessary, can only be effective if individual owner-occupiers invest in and use that energy conservation technology. This, however, entails a change in their decision-making behaviour. If the government can stimulate the owner-occupiers to change their behaviour and use energy conservation



Source: Green and Kreuter (1999)

Figure 1. Model for developing an intervention strategy.

technology, then the goal of energy reduction will become feasible.

In this study, we asked the following questions: (1) what are the determinants of energy-relevant behaviour of owner-occupiers, (2) do different segments within the target group have different determinants of behaviour, and (3) what policy instruments are most effective in changing their behaviour? To answer these questions we chose the PRECEDE-PROCEED model of Green and Kreuter for changing the behaviour of individuals as our theoretical basis. We then surveyed owner-occupiers of residential dwellings built before 1975 to catalogue the determinants of their energy-relevant behaviour. The specific behavioural determinants that are influenced by different policy instruments were then catalogued. And finally, we matched the determinants of owner-occupiers' behaviour determinants to specific policy instruments.

## Theoretical basis

Our approach to answering the three research questions is based on Green and Kreuter's model (Green and Kreuter, 1999). The model, sometimes referred to as the PRECEDE-PROCEED model, was designed for changing the behaviour of individuals. Figure 1 gives an overview of the model.

### SIX STEPS IN OUR APPROACH

Our approach consisted of six different steps. Our steps 1, 2-4 and 5-6 matched the first, second and third phase respectively of the Green and Kreuter model (Figure 1).

Our first step was to determine the national goals of CO<sub>2</sub> reduction and the derived targets for our target group. In step 2, we established the relevant determinants of behaviour. Here, we diagnosed the behaviour of owner-occupiers

and established the relative influence of determinants of behaviour of the target group. This step was done through interviewing focus groups and then surveying the target group on a larger scale. In step 3 we assessed the relevant predisposing, enabling and reinforcing factors that make up the determinants of behaviour specific to the target group. In step 4 we determined which factors are inherent in existing policy instruments. Based on a literature study, their 'active ingredients'—their specific influence on behavioural determinants—were established. In step 5 we choose the matching instruments—instruments that could effectively alter specific determinants. The step was based on matching the factors influencing behaviour for the target groups (step 3) with the factors inherent in policy instruments (step 4). In step 6 we formulated an intervention strategy.

## Energy-relevant behaviour of owner-occupiers

### INTRODUCTION

Determining the energy-relevant behaviour of owner-occupiers consisted of a two-part project: In the first part of the project, we gathered empirical data on the marketing variables of owner-occupiers in older dwellings in the Netherlands. This data was gathered in the last half of 2002 and the first half of 2003 and is only summarized here (see Hoekstra and Kersloot, 2003, for the complete report). In the second part of the project, we analyzed the data to determine if different segments within that target group could be distinguished.

### EMPIRICAL RESEARCH PROJECT

The research project was based on a combination of qualitative and quantitative research methods. Before this research project, we only had a vague idea of the determinants of en-

ergy-relevant behaviour of owner-occupiers. In order to get a deeper insight into these determinants, we started the research project with focus groups.

The participants of these focus groups were selected by means of a short questionnaire that was distributed in two neighbourhoods (one in Utrecht and one in Rotterdam) with a relatively large share of older, owner-occupied dwellings. Through the focus groups we tried to get insight into all possible determinants of energy-saving behaviour of the owner-occupiers. The focus groups resulted in an extensive overview of relevant aspects that might play a role in energy-saving behaviour.

This overview was used to construct a structured questionnaire (closed questions) that was sent to 5 000 households in older, owner-occupied, single-family dwellings. The response rate was close to 50%. The questionnaire dealt with the following issues:

- Characteristics of the dwelling (dwelling type, number of rooms, age, market value)
- Renovations in the dwelling (kind of renovations, reasons for carrying out renovations)
- Double glazing (presence of double glazing, reasons for installing or not installing double glazing)
- Energy-efficient central heating boiler (presence of such a boiler, reasons for installing or not installing an energy-efficient central heating boiler)
- Insulation facilities (presence of such facilities and reasons for installing or not installing them)
- Information (where do respondents obtain information on energy-saving measures?, what is the credibility of the different information-providing parties?)
- The respondents' evaluation of policy instruments (subsidies, information campaigns, higher energy prices, norms on energy-efficiency in dwellings etc.)

### Characteristics of the older, owner-occupied dwellings and their residents

About 3.5 million Dutch households live in an owner-occupied dwelling that was built before 1975. These are mainly terraced dwellings (attached dwellings) (45%) and detached dwellings (35%). Two thirds of the dwellings have four or five rooms, whereas 27% has more than five rooms. More than half of the older Dutch owner-occupied dwellings are in communities that have between 5 000 and 50 000 inhabitants. More than 80% of the respondents live together with a partner and in 42% of all households children live at home. Table 1 shows characteristics of the older-owner-occupied dwellings and their residents.

### Presence of energy-saving facilities in the dwelling

Double-glazing is rather common in older Dutch owner-occupied dwellings. In 84% of all dwellings, double-glazing is present in most rooms of the dwelling, whereas 11% of the dwellings have double-glazing in at least some rooms. A mere 5% of all older owner-occupied dwellings, has absolutely no double-glazing at all. Energy-efficient central heating boilers are present in 62% of all old owner-occupied dwellings. The insulation situation differs according to the type of insulation facilities that one is referring to. Insulation of the walls and the roof is rather common, whereas floor or front insulation is less often applied. Not all people are aware of the insulation facilities that are present in their dwelling. About a quarter of all respondents simply did not know whether a particular insulation facility was present or not.

### Renovation is a 'natural moment' for taking energy-saving measures

The research clearly showed that many energy-saving measures were taken within the context of a wider renovation of the dwelling. In 49% of the cases, double-glazing was installed within the framework of a larger renovation project.

**Table 1. Basic characteristics of older, owner-occupied dwellings and their residents.**

	N.	%
<b>Dwelling type</b>		
Detached dwelling	896	35
Semi-detached dwelling	493	20
Terraced dwelling (attached dwellings)	1 143	45
Total	2 531	100
<b>Date of building</b>		
Before 1900	149	6
1900 till 1945	845	34
1945 till 1965	715	28
1965 till 1975	802	32
Total	2 511	100
<b>Number of rooms</b>		
Less than 4 rooms	190	7
4 or 5 rooms	1 657	66
More than 5 rooms	678	27
Total	2 525	100
<b>Type of household</b>		
Single	424	17
Couple without children at home	987	39
Couple with children at home	1 063	42
Other	31	2
Total	2 505	100

source: Hoekstra and Kersloot, 2003

For insulation material, this percentage is even higher: 65%. The installation of an energy-efficient central heating boiler went accompanied with a larger renovation in 37% of all cases.

These figures clearly show that a renovation is a 'natural moment' for taking energy-saving measures. Policies that stimulate energy-efficient behaviour should anticipate this, for example by providing people who are just starting to renovate with persuasive information.

#### **Reasons for investing in double glazing, insulation or an energy-efficient boiler**

We found that owner-occupiers take energy-saving measures for two main reasons: to improve the comfort of the dwelling and to reduce the energy costs. More than 60% of the respondents who have installed double-glazing and/or insulation material did this primarily because these measures improve the indoor climate. About a quarter of the respondents primarily took these measures for financial reasons (reducing energy costs). Environmental considerations were seldom mentioned as the prime reason for installing double-glazing or insulation material, although they were mentioned as secondary or tertiary reasons. Energy-efficient central heating boilers are mainly installed to reduce the energy costs (74% of the respondents) or because of their large capacity (20% of the respondents).

#### **Reasons for not taking energy-efficient measures**

The respondents who had not (yet) taken energy-saving measures within their dwelling were asked why they had not done so. Financial reasons were considered to be the main reason for this; energy-saving measures cost a great amount of money and it takes a long time before their costs are recovered. Another reason reported is the fuss that the installation of energy-saving facilities can give. Finally, we found a substantial group of people who have simply never thought of taking energy-saving measures.

#### **Information on energy-saving facilities**

There are many different organizations that provide information on saving energy in the dwelling. These include electricity companies, local governments, do-it-yourself shops, and consumer organisations. Furthermore, family, friends and colleagues also provide information. Information that comes from private non-commercial parties (e.g. consumer organisations) is considered to be most reliable.

Most owner-occupiers ask for information or advice before they take energy-saving measures. For example, 78% of the respondents who have installed an energy-efficient central heating boiler requested information before installing the boiler. Of these information-requesting respondents, 80% indicated that the provided information did not influence their decision to install an energy-efficient central heating boiler. However, for 15% of the information-requesting respondents, the information was decisive; without information and/or advice these people would not have installed an energy-efficient central heating boiler. A further 5% indicated that the provided information facilitated the decision to install an energy-efficient central heating boiler.

#### **Subsidies for energy-saving behaviour**

Dutch owner-occupiers who invest in double glazing, an energy-efficient central heating boiler or insulation facilities may be entitled to subsidies (although many of these subsidies have recently been abolished). These subsidies mainly have an enabling effect. For example, 36% of the households who received a subsidy for installing an energy-efficient central heating boiler, indicated that these subsidies facilitated their decision to invest in such a boiler.

#### **TOWARDS A SEGMENTATION**

Based on our analysis of the survey data, we distinguished two segments of owner-occupiers: a low-income group and a high-income group. These segments have different profiles and different determinants of energy-relevant behaviour (Table 2).

From our analysis of the two segments we conclude the following.

- A substantial part (30%) of the low-income group consists of one-person households.
- Couples (with or without children) are over-represented in the high-income group.
- High-income households tend to live in larger dwellings than low-income households.
- The majority of the owner-occupiers in older dwellings are not yet familiar with the so-called Energy Performance Advice (EPA). If a household requests an EPA, a consultant visits the dwelling and examines how it can be made more energy-efficient. This results in a report that compares different energy-saving measures such as installing double-glazing, wall-insulation or an energy-efficient central heating boiler. The report compares the costs of the different measures, the expected energy savings, and the time period in which the costs of the measures can be recovered. Advice costs about 200 Euro.
- Households within the high-income group are more familiar with EPA than households within the low-income group.
- About one in every three households has requested information with regard to saving energy in the dwelling (see section on information on energy-saving facilities). Households within the high-income group request information more often than households within the low-income group.
- Financial reasons are the most important for taking energy-saving measures within the dwelling. Of the six possible reasons for making the dwelling more energy-efficient (the six most frequently mentioned by the focus groups); financial reasons ranked first.
- This reason weighs heavier for households in the low-income group than for households in the high-income group.
- Compared to the low-income group households in the high-income group more often take energy-saving measures in order to increase the comfort of the dwelling (less cold and draught).

- The fact that the reduction of the energy costs is, in general, the main reason for taking energy-saving measures seems to contradict our earlier conclusions. After all, earlier in this section we observed that double-glazing and insulation facilities are mainly installed for reasons of comfort. Differences in perception might explain this paradox. Whereas the term 'energy-saving measures' is directly associated with less energy-consumption and therefore less energy-costs, double-glazing and insulation facilities are probably not primarily perceived as energy-saving facilities, but rather as comfort-increasing facilities.
- Households within the high-income group attach more importance to 'a comfortable life' than households within the low-income group.
- Government can stimulate energy saving within the dwelling in different ways (see Appreciation of policy measures, Table 2). Clearly, very few people, especially within the lower-income group, would applaud an increase of the energy costs. On the other hand, most respondents are favourable to measures that would improve their financial situation, such as higher subsidies or more transparency with regard to the costs and revenues of energy-saving measures. For most policy options, the low-income and the high-income segments only slightly differ in their appreciation.

**Table 2. Owner-occupiers in older dwellings: main differences between high-income and low-income households.**

	Low-income households		High-income households	
	N	%	N	%
<b>Household type</b>				
single person	265	30	119	9
couple without children at home	277	32	594	46
couple with children at home	322	37	579	44
Other	13	2	14	1
Total	877	100	1 306	100
<b>Number of rooms</b>				
3 rooms or less	95	11	74	6
4 or 5 rooms	636	73	797	61
more than 5 rooms	143	16	433	33
Total	874	100	1 304	100
<b>Familiar with EPA?</b>				
Yes	233	27	512	39
No	638	73	786	61
Total	871	100	1 298	100
<b>Information on energy-saving</b>				
asked for information on energy-saving	254	29	458	35
did not ask for information on energy-saving	623	71	850	65
total	877	100	1 308	100
<b>Main reason for energy-saving in the dwelling</b>				
reduces the energy costs	535	75	731	63
Increases the comfort in the dwelling	97	14	282	24
Contributes to a better environment	35	5	103	9
take advantage of subsidies	4	1	3	0
Increases the value of the dwelling	11	1	10	1
keeps the dwelling in good condition	29	4	36	3
Total	711	100	1 165	100
	N	Average value	N	Average value
Average appreciation of the value 'a comfortable life' (1= very low appreciation, 5 = very high appreciation)	808	4,0	1 286	4,1
Average appreciation of the value 'protection of environment' (1= very low appreciation, 5 = very high appreciation)	800	3,4	1 265	3,1
<b>Average appreciation of policy measures to promote energy-saving (1= very bad, 10= very good)</b>				
Higher taxes on energy	743	2,6	1 184	2,9
More and better information on energy-saving	727	6,7	1 179	6,9
Campaigns to change energy-relevant behaviour	725	6,5	1 183	6,9
Give better insight into the revenues and costs of investments in energy-saving	756	7,2	1 193	7,5
Stricter norms with regard to the energy-efficiency of dwellings	716	5,7	1 171	6,1
More subsidies to promote energy-saving behaviour	779	7,8	1 222	7,7
More subsidies for the producers of energy-efficient facilities	714	7,3	1 179	7,0

source: Hoekstra and Kersloot, 2003

## Policy instruments and determinants

In this section, we describe the types of policy instruments that can be used to influence the behaviour of target groups. Furthermore, we describe various determinants of behaviour. In the last section, we match the instruments to the determinants.

### POLICY INSTRUMENTS

The literature (e.g. WRR, 1992) distinguishes between four main groups of policy instruments. These four types of instruments are broadly accepted in policy science and influence behaviour in different ways: Regulatory instruments (1) are mainly based in the mechanism of force, (2) financial instruments are characterised by financial gain, (3) communicative instruments influence behaviour by persuasion and seduction, and (4) physical provisions work by force and as facilitators. An example of physical provisions are speed bumps to reduce the speed of traffic in certain areas. We sub-divided these four types into specific instruments (Table 3).

### DETERMINANTS OF BEHAVIOUR

Green and Kreuter (1999) describe three general categories of factors that make up the determinants that affect behaviour and environment. Each has a different influence on behaviour. Predisposing factors (1) are internal antecedents to behaviour, belonging to the decision maker, they motivate the behaviour. Enabling factors (2) are the external antecedents to behaviour, belonging to the situation, they allow new behaviour to be realized. Reinforcing factors (3) are those consequences of an action which determine whether the decision-maker receives feedback.

We sub-divided these three groups into specific determinants (Table 4). Please note that these are 'changeable' determinants. Other, non-changeable determinants also exist, but they are beyond the scope of our study.

### MATCHING INSTRUMENTS AND DETERMINANTS: THE INSTRUMENT TABLE

Based on the above findings and a review of both the empirical and theoretical literature in the field of policy instruments and interventions (e.g. Bartholomew et. al., 2001; WRR, 1992; Lulofs and Lettinga, 2003; Klok, 1991), Egmond et. al. (2004) analysed the various instruments in terms of their influence on the predisposing, enabling and reinforcing factors of the model that make up the determinants of behaviour, and determined their 'active ingredients'. This is presented in the form of an instrument table (Table 4) where the grey cells indicate the active ingredients of the instruments. For more information about this instru-

ment table, we refer to Egmond and Bruel (2004) and Egmond et.al. (2004).

## Intervention strategy and conclusions

Based on our findings, we conclude that 'predisposing' and 'enabling' determinants rather than 'reinforcing' determinants are most influential on the behaviour of this group of owner-occupiers.

Furthermore, we identified two different segments within the target group: a low-income group and a high-income group. These groups have different behavioural determinants. Low-income groups are mainly influenced by predisposing determinants, like awareness, attitude and knowledge. The higher-income groups can mainly be influenced by enabling determinants.

### LOW-INCOME SEGMENT

The policy instruments most effective in changing the behaviour of the low-income group are:

1. communicate the advantages of saving energy
2. offer information on saving energy and
3. provide subsidies or fiscal incentives for saving energy.

From the survey we learned that the low income group is less interested in and therefore less active in gathering information on saving energy, and also uses the policy instruments that facilitate this (such as EPA) less, than the high income group. Consequently, the intervention strategy should focus on the predisposing determinants. The low income group is susceptible to arguments such as saving money by means of energy conservation. Therefore, communication about energy conservation should focus on financial aspects. Preferably, the providers of this communication should be interest groups for consumers, such as the Dutch Consumers' Association (Consumentenbond) and the Association of Housing Owners (Vereniging Eigen Huis). After all, the survey research has shown that owner-occupiers perceive these organisations as providers of reliable and credible information.

Furthermore, our results show that subsidies or fiscal incentives for energy saving measures facilitate energy-saving behaviour. These subsidies or fiscal incentives should be easy to apply for, and the subsidy or fiscal incentive should be awarded at the time that people make investments.

Table 3. Instruments in detail.

1. Regulatory	2. Financial	3. Communications	4. Physical provisions
1.1 General law	2.1 Subsidy	3.1 Information and promotion	4.1 Infrastructure provisions
1.2 Specific permits	2.2 Levy	3.2 Training	4.2 Technical steering of behaviour
1.3 Enforcement	2.3 Tax-differentiation	3.3 Personal advice	
1.4 Agreements	2.4 Financial constructions	3.4 Demonstration	
		3.5 Benchmarks	

Source: Egmond et al. 2004

**Table 4. Instrument table: match of instrument and determinants: the active ingredients.**

	Factors of the model													
	Predisposing factors					Enabling factors			Reinforcing factors					
<i>Grey cells indicate that there is an effect on a determinant,</i>	Awareness	Knowledge	Social norms	Subjective norm	Attitude	Self-efficacy	External financial resources	External technical resources	External organisational resources	New skills	Feedback of peer organisations	Feedback of experts	Feedback of authorities	Feedback of customers
Policy instruments:														
1.1 General Laws and Rules			2		1								1	
1.2 Specific permits			2		1								1	
1.3 Enforcement	1		2	1	2		1	1					2	
1.b Covenants and agreements	1		1	1	2						2		1	
2.1 Subsidy	1				1		2						1	
2.2 Levy	1				1		2						1	
2.3 Tax differentiation					1		1						1	
2.4 Financial constructions					1		2		1	1		1		
3.1 Information and promotion	2	1	1	1	2	1		1		2	1	1	1	1
3.2 Training		2				1		1	2	2		1		
3.3 Personal advice		2			1	2		1	2	1		1		
3.4 Demonstration	1	1			1	2		1		1	1	1		
3.6 Benchmarks	1			1							2	1		2
4.1 Infrastructural provision	1				1	1		2	1					
4.2 Technical behavioural steering	1				1	1		2	1					
A number in a cell means: 2 is a primary effect; 1 is a secondary effect.														

Source: Egmond et al., 2004

**HIGH-INCOME SEGMENT**

In contrast, to the low-income group, the policy instruments most effective in changing the behaviour of the high-income group:

1. provide personal advice. This may be face-to-face advice, or a computer-based tailoring system. The face-to-face advice is in general more effective, but the computer-based system is much more cost-effective.
2. appeal to housing comfort and the societal responsibility of the respondent.

In light of the above, we conclude that the Energy Performance Advice instrument needs to be made more effective. Through this Dutch policy instrument, people can receive personal advice (after an inspection of their house) on how to reduce their energy bill and increase their comfort. For this group of owner-occupiers, a broadening of EPA to include habitual behavioural change (such as only washing with a full washing machine, closing the curtains at night, etc.) can be very successful.

The high-income segment is already motivated to conserve energy. Therefore, the intervention strategy should focus on the enabling determinants and emphasize the link between energy conservation and comfort. Furthermore, they should be given practical information on how to turn their positive intentions towards energy conservation into practical actions.

For both high and low-income households, renovations are a ‘natural moment’ for taking energy-saving measures. Therefore, an intervention strategy for owner-occupiers should connect the information flow on energy saving measures to the information flows of organisations that are related to renovation of dwellings (such as do-it-yourself shops).

**THE NEXT STEP**

In this paper we lay the basis for an intervention strategy that will effectively influence the behaviour of owner-occupiers of older dwellings to invest in and use of energy-conservation technology. Governments and energy agencies that design energy conservation policies and intervention strategies must match the active ingredients of the instruments with the determinants of behaviour of the target group.

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