3 Do energy performance policy instruments work on owner-occupiers?

Abstract

An urgency and necessity is associated with achieving the energy saving gains reported as languishing in the existing owner occupied housing stock. Success in this regard relies, in part, on the policy instruments in place. Many of the same instruments, including subsidies, audits and information tools, have been used for decades yet there is uncertainty and confusion about their impact. In response, bottom up data from a survey of owner-occupiers was used to evaluate the complete range of national instruments available in the Netherlands. Associations between adopting energy saving measures and using policy instruments were analysed. With the exception of the EPC, energy tax and energy saving loans, statistical tests found instruments to be associated with the adoption of energy saving measures. Information and financial instruments were described as the most influential. However, approximately 40% of respondents used instruments but did not consider them influential. While associations were found between instruments and adopting measures they were not at the transformative level that climate change policy demands.

§ 3.1 Introduction

The existing housing stock is reported to hold considerable energy saving potential. Space and water heating in these dwellings is responsible for 40% of the total energy consumption and greenhouse gas emissions in Europe (cited in Stieß and Dunkelberg, 2013, p. 250). Much of the stock is reported as 'leaky' constructed before energy standards made a significant entrance to building regulations. Commentators in turn argue for dramatic cuts in energy use and the research agenda is littered with calls for 'achieving zero', 'deep retrofit', 'transforming existing dwellings' and 'scaling up efforts' (Boardman, 2012; Curtain and Maguire, 2011; Delhagen et al., 2009). Accordingly, ambitious policy targets have been established reflecting both the urgency and scale of effort expected. In the Netherlands, targets of 20% reduction in greenhouse gas emissions by 2020 mean that 300,000 buildings annually should be improved by at least two energy rating classes (Ministry of Economic Affairs et al., 2014). To meet

targets in Britain "one building would need to be retrofitted every minute for the next 40 years…" (cited in Wilson et al., 2015, p. 12).

Meeting these ambitious targets relies, in part, on the policy instruments in place. A vast array of instruments has been designed to remove barriers to adopting energy saving measures that households are considered to face and to transform the market towards energy efficient products and dwellings. Many of these instruments have existed in various forms for decades. Despite the longevity of many instrument types there is uncertainty and confusion about impact, "despite all these inducements, instructions, prompts and prods, homeowners remain stubbornly resistant to improving their homes' energy efficiency by making structural changes to their heating systems, walls, windows, doors, lofts and basements" (Wilson et al., 2015, p. 19). This is part of the phenomenon termed the 'energy efficiency gap' whereby the adoption rate of energy efficiency measures fails to meet full potential (Pelenur and Cruickshank, 2014; Allcott and Mullainathan, 2010; Jaffe and Stavins, 1994). The energy efficiency gap is explained as "a complex phenomenon in which technical, institutional, market, organizational and behavioural factors all play a significant role and are interconnected" (Weber, 1997; Pelenur and Cruickshank, 2014).

Efforts to explain the gap between policy aspiration and reality are resulting in increasingly sophisticated lines of inquiry especially relating to socio-demographic and psychological factors of energy use and investment behavior (Abrahamse et al., 2005; Stieß and Dunkelberg, 2013; Scott et al., 2014; Pettifor et al., 2015; Risholt and Berker 2013; Bartiaux et al., 2014; Wilson et al., 2015; Frederiks et al., 2015). Lagging behind is sophistication in knowledge about the role of instruments. Research attempts to unravel instrument impact are plagued by methodological problems including small sample sizes, sample bias and the intractable issue of concluding causal impact in non-experimental research (see Alberini et al., 2014; Abrahamse et al., 2005; Frederiks et al., 2015). This is against a backdrop of little or no official monitoring and evaluation of policy instruments.

To add knowledge to the instrument dimension of the energy efficiency gap a framework was developed and used in Murphy et al. 2012 (Chapter 2) to conduct a top down evaluation of national policy instruments used in the Netherlands. A conclusion from this evaluation was that many unknowns surround the life of instruments once they leave the realm of policy makers and implementation authorities. Stakeholders interviewed for the top down evaluation lamented that instrument evaluations, when conducted, focused on user satisfaction and not impact per se. Many of the perceived successes and or failures of instruments were anecdotal. In response, this chapter uses bottom up data from a survey of owner-occupiers to evaluate the complete range of national instruments available in the Netherlands in 2012. The main question is: does an association exist between using instruments and adopting energy saving measures? In essence, do instruments work? As with the top down evaluation and all the research

presented in this thesis the survey focused on instruments aimed at reducing space and water heating in owner-occupied dwellings.

The survey consisted of questions about energy saving measures adopted within the years preceding the survey. Questions about all national instruments available to private owner-occupiers at that time were included. The survey also gathered data on motivations for energy use and perceived influences of instruments. Information about respondents was sought with questions about household and dwelling characteristics. This was to contextualize the sample and to control findings by comparing them to generally accepted findings in the field. Analysis, both descriptive and statistical, was conducted on data from over 5,000 survey respondents. Descriptive analysis centered on whether householders reported an association between the adoption of energy saving measures and the use of instruments. Pearson's chi square tests were used to identify whether an association between adopting measures and instruments could be statistically proven.

In section 2, the conceptual background and previous research that influenced this research including the formulation of the survey and subsequent analysis is summarised. In section 3, the methodology is described. Section 4 contains the results divided into:

- Contextual aspects relating to the quantity of measures adopted, motivations for adopting measures and reasons for not adopting measures
- Respondent answers about how instruments influenced them
- Statistical test results of associations between dwelling and household characteristics and the use of instruments.
- The associations between the use of instruments and the quantity of energy saving measures adopted.

Section 5 summarises the link between results and other research findings while in section 6 the conclusions and recommendations are presented.

§ 3.2 Background

§ 3.2.1 Policy instruments

Policy instruments have been defined as 'elements in policy design that cause agents of targets to do something they would not do otherwise or with the intention of modifying behaviour to solve public problems or attain policy goals' (cited in Birkland, 2005, p. 170). The expectation following this definition is great, instruments influence the target group so that government policy is pursued and reached. Progress reports and national plans typically give way to this definition presenting success stories of instrument take up and resulting estimated energy savings. Behind such stories lies a miasma. Do instruments play a role in triggering these savings? Do instruments have the intended impact? Do instruments urge householders to do more than they originally intended? Data that delves into these questions is severely lacking yet vital for a full and comprehensive understanding of household energy efficiency policy.

§ 3.2.2 Removing barriers and transforming markets

Policy instruments for improving energy performance of existing dwellings are typically developed from an analytical framework based on overcoming barriers and transforming markets (Blumstein et al., 1980, Wilhite et al., 2000; Weiss et al., 2012; de T'Serclaes 2007; Boardman, 2012; Wilson et al., 2015). The result is instruments designed to overcome information and financial barriers such as energy audits and subsidies. Instruments such as Energy Performance Certificates (EPCs) meanwhile are theorised as attaching an economic advantage to energy efficient dwelling thus transforming the market. The energy efficiency gap is often explained as a failure of instruments to adequately remove barriers (Weber, 1997; Blumstein et al., 1980, Wilhite et al., 2000; Pettifor et al., 2015).

The 'barrier model', on which many instruments are based, is heavily criticised. Conceptualizing householders as psychologically motivated individual decision makers is considered seriously flawed (Shove et al 1998; Collins 2003; Wilson et al 2015). Many researchers and policy advisors argue for a deeper understanding of the target group so that instruments can be designed more appropriately (Nilsson and Wene, 2011; Wilhite et al., 2000; Wilson et al., 2015; Frederiks et al., 2015; Rosenow and Sagar, 2015). The simplicity and problematic of the current system is

encapsulated in the statement of Frederiks et al. (2015, p. 576) "there is no single conceptual framework or model that is universally accepted by scholars as providing an all-inclusive explanation of energy consumption and conservation, nor any single approach that precisely predicts individual differences in such behavior".

§ 3.2.3 Energy saving investment in private owner-occupied dwellings-what is known

Previous research allows for a number of tentative generalisations about why households adopt energy saving measures and about household and dwelling characteristics that influence the adoption of measures. Research identifies particular types of energy saving investment that can to be broadly associated with household lifecycle and occupancy stages; results which form the basis for segmentation studies (Sutterlin et al., 2011; Frederiks et al., 2015).

Studies generally conclude that most householders take measures to reduce energy costs and to improve comfort (Bruel and Hoekstra, 2005) while the main reason for not taking measures is cost (Herring et al., 2007; Sardianou, 2007). Several studies identify links with income and the adoption of energy saving measures. Bruel and Hoekstra (2005) found that higher income groups were more likely to invest in measures to improve comfort with lower income groups investing to save money. The general conclusion from previous research is that higher income households invest in the energy saving measures while lower income householders curtail their energy use or take lower level energy saving measures (Pfaffenberger et al., 1983; Sardianou, 2007; Dillman et al., 1983). Exceptions do exist however with income found to be insignificant in the studies of Weiss et al. (2012) and Curtis et al. (1984).

Householder age is considered a common determinant of investment in energy saving measures. Sardianou (2007) found that as age increased the number of energy saving measures adopted decreased. Likewise, Hirst and Goeltz (1985) found that younger and older households take fewer actions than those of middle age. Meanwhile, Curtis et al. (1984) found that the 31-35 year age group carried out the most energy saving measures. Exceptions again exist with Weiss et al. (2012) finding that age had no influence on retrofitting.

Household size is considered another influence for energy retrofitting. Sardianou (2007) identified a link between increasing household size and number of measures adopted. Curtis et al. (1984) found that households with two to four people took a greater number of measures than other household sizes. Likewise, Herring et al. (2007) found two person households most active in energy retrofitting.

Less clear are the influences of education and occupation with some studies finding these are significant and others less so (see Weiss et al., 2012; Curtis et al., 1984).

§ 3.2.4 Policy instruments for saving energy- what is known

As opposed to research about household and dwelling characteristics, previous research is not sufficiently wealthy to allow for general statements about how instruments stimulate energy saving investment. Evaluations that exist are typically focused on single instruments and specific to the region of implementation (Adjei et al., 2011; Brounen and Kok, 2010; Gram-Hanssen, 2007; Rosenow., 2012). The dearth of evaluation that exists means that evidence is drawn from different countries with the caveat that design and implementation differences exist.

With this in mind it remains that the language of instrument impact is often negative, special loan schemes are reported to suffer from low take up, energy taxes as non-influential, subsidy schemes frequently criticised for significant numbers of free riders, information campaigns and instruments are said to reach the already interested and motivated (See Murphy et al., 2012 (Chapter 2); Murphy 2014a (Chapter 4); Murphy 2014b (Chapter 5); Joosen et al., 2004; BZK, 2011; ECN, 2010; CBS, 2011; Adjei et al., 2011; Hamilton et al., 2010; Wilson et al., 2015). Even best practice instruments like the federal loan and subsidy scheme in Germany is criticised for its 'tremendous remaining potential' (see Wilson et al., 2015), Murphy 2014c (Chapter 6). Meanwhile, flagship alternative instruments like the UK Green Deal are dismantled in infancy due to a lack of public appeal (Rosenow and Sagar, 2015).

§ 3.3 Methodology

To improve knowledge of the instrument dimension of the energy efficiency gap a survey was undertaken of Dutch owner occupiers in 2012. Out of the 7.4 million dwellings in the Netherlands, 55% belong to the owner occupied sector (Eurostat, 2015). Owner-occupiers are considered to have different requirements and experiences with policy instruments than social or private rented dwellings.

The survey included over 90 questions, mostly multiple choice with options for respondent input, pertaining to the use of instruments available at the time (see table 3.1 for the instruments that were included in the survey), the adoption of

energy saving measures and contextual aspects, for example, dwelling age and householder income. The complete survey is reproduced in Appendix 3 (translated to English from the Dutch original).

FINANCIAL	INFORMATION-ORGANISATIONS	INFORMATION	OTHER
Meer met Minder subsidy	Home owner association	Interactive web pages	Building regulations
Energy audit subsidy	Builders/installers	EPC	
High performance glazing subsidy	Meer met Minder organization	Energy audit	
Local/provincial subsidy	Environmental consumer organisation		
VAT reduction	Energy Company		
Energy saving loan			
Energy tax			

TABLE 3.1 Instruments forming part of survey

A focus of the survey was energy saving measures aimed at reducing space and water heating as these represent financial investment and are considered to contribute to long term reduction in energy use. The complete list of measures that appeared in the survey are listed below. These are the measures that appear as recommendations on the official national energy audit and EPC.

- Boiler replacement
- High performance glazing
- Roof insulation
- Floor insulation
- Wall insulation
- Heat recovery shower
- Heat recovery ventilation
- Insulation of piping
- Draught proofing
- Renewable technology
- Other

A key objective of the survey was to evaluate the EPC (see Murphy 2014b/Chapter 5), therefore, recent homeowners registered in the EPC database and recent homeowners registered as members of the Dutch Homeowners Association without an EPC were approached. Another objective, and one which forms the basis for the research presented here, was to explore and evaluate the effectiveness of the complete range of national instruments available to owner occupiers to reduce energy consumption for space and water heating. This scope sets this research apart from other evaluations

which typically analyse single instruments. The central research question is basic but crucial - is there an association between national policy instruments and the adoption of energy saving measures? Data from a total of 5071 owner-occupiers, either registered as holding an EPC or as a member of the national homeowner's association form the basis for this analysis.

Descriptive analysis of motivations for energy saving measures, funding, and the influence of instruments in the opinion of respondents was conducted. Statistical analysis of the association between the adoption of energy saving measures and instruments and householder contexts was also carried out. Given policy attention to the need for deep retrofit/adoption of several energy saving measures instead of 'one-off measures', analysis of the association between the quantity of energy saving measures adopted and instruments was conducted. Pearson's chi square tests were used to find statistical associations based on Field (2009).

Several representative issues were encountered with the sample (Eurostat, 2009; CBS, 2010 and 2012; CIA, 2012). Compared to the national average apartment dwellers were underrepresented as were one person households. Higher educated and higher income households were overrepresented while unemployed households were underrepresented. The majority of respondents belonged to the 40-65 age category. These representative issues mirror the sample bias which is typically encountered in this field (see Hirst and Goeltz, 1985; Stern et al., 1986; Wirtshafter, 1985; Abrahamse et al., 2005). A consistent finding in this research field is that instruments such as energy audits are used by higher income and higher educated older households with a greater interest in energy saving than is found in the general population. Socio-economic and dwelling data was collected to provide contextual information and as a means to check validity of data. Representative issues were not considered major and were not considered to impact on the research question therefore no measures were adopted to correct for this.

§ 3.4 Results

§ 3.4.1 Descriptive: Measures, funding, motivations and instrument influence

Of the 5071 respondents to the survey a sizable 3829 (75.5%) adopted an energy saving measure in the preceding four years. The norm was the adoption of one or two measures at 33% and 29% respectively. The most frequently cited reason for energy

retrofitting was to reduce bills, followed by improving comfort. Interestingly, while respondents were confident that comfort improved, just over half could confirm that energy bills had reduced. The explanation for this is not obvious. Perhaps respondents naturally choose saving money as a motivation from a list of multiple choice survey options but in reality it is not as strong as assumed by policy makers. This conforms with both old and recent policy critiques in which an over-emphasis on the financial aspects of energy saving to householders is highlighted (Magat et al., 1986; Wilson et al., 2015, Rosenow and Sagar, 2015).

Almost 40% of respondents who invested in energy saving measures spent over €4000, with savings the main funding source (in the case of 83% of respondents). Meanwhile, the main reason for not investing in energy retrofitting, 38% of respondents, was that dwellings were considered to be adequately energy efficient. This is considered an interesting result since the survey audit and EPC data show that in policy terms such dwellings would not be considered energy efficient.

Respondents were asked whether policy instruments influenced them in some way in their energy retrofitting and how they would describe this influence. 57% of respondents who used national financial instruments listed these as influential in adopting energy saving measures. The performance based Meer met Minder subsidy and renewable technology subsidy appeared most influential. Meanwhile, 60% of respondents who contacted national organisations about retrofitting described these as influential. 27% of respondents with an EPC/audit stated that this was an influential factor in their decision making while 16% of respondents who applied for a building permit described this as an influence.

The energy tax performed poorly in descriptions of its influence with 2314 respondents (46%) aware of the tax, of which 880 were able to estimate how much tax they pay of which, 178 stated it influenced them in some way in their energy use. Special energy saving loans showed a weak influence with 1% of the sample using one of the three loans then available.

To explore the influence and effectiveness of instruments in greater detail respondents who answered positively that instruments formed an influence in their decision making were asked three more detailed questions. In the case of information instruments, respondents were specifically asked whether the instrument influenced them to:

- adopt energy saving measures that they previously had not considered
- adopt measures because the instrument confirmed their ideas about energy saving measures
- adopt more energy saving measures than they had planned

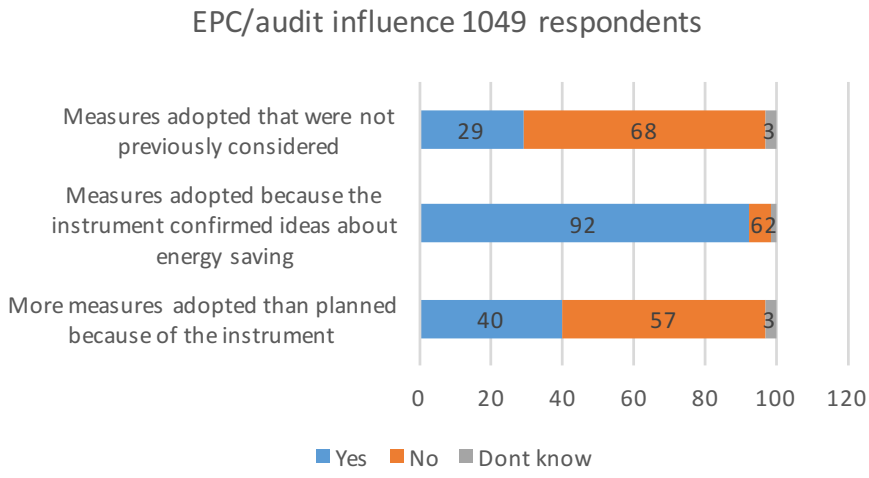

FIGURE 3.1 Influence of the EPC/audit

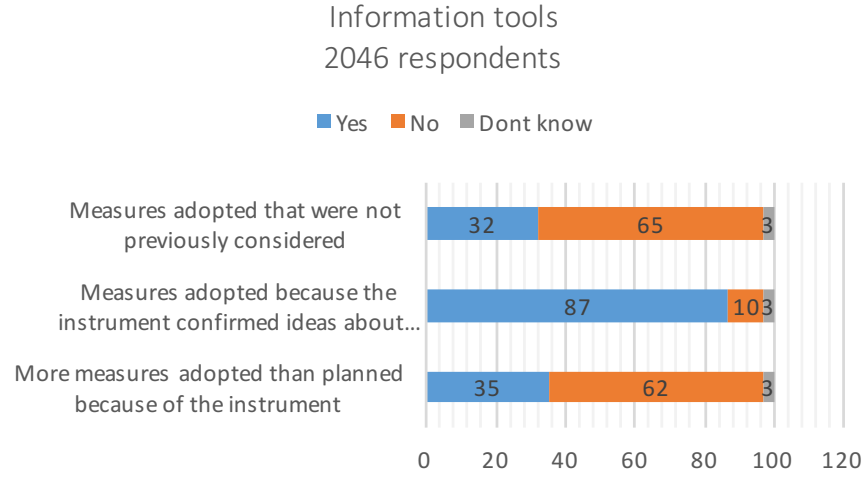

FIGURE 3.2 Influence of information tools

27% (1049) of respondents in possession of an EPC/energy audit stated that this formed an influence on adopting energy saving measures . 61.5% (2046) of respondents who contacted national organisations or used on online information tool stated that this formed an influence in their decision to adopt energy saving measures. The strongest influence of the information instruments was to confirm the information about energy saving already held by householders at 92% and 87% for the EPC/audit and general suite of information tools respectively, see figures 3.1 and 3.2. However,

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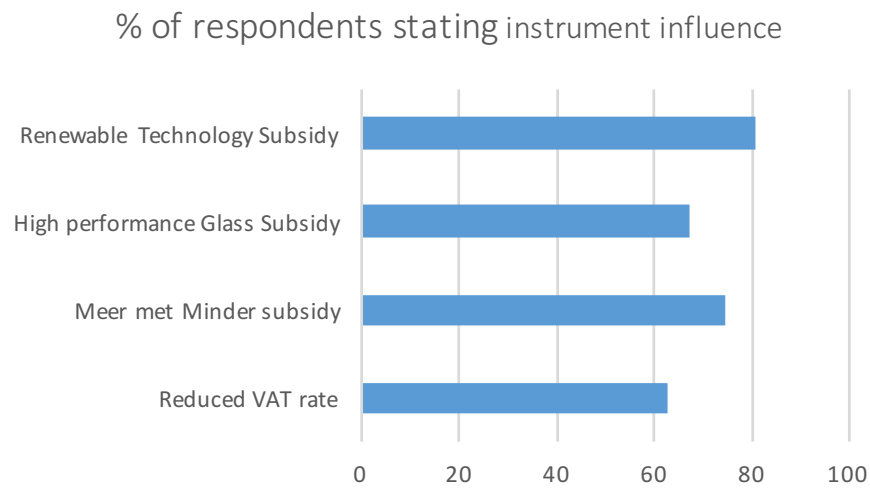
instruments were moderately influential at stimulating the adoption of energy saving measures that householders had not previously considered and at adopting more measures than originally planned. These results show some success of instruments at overcoming the barriers of inadequate and insufficient information.

In the case of financial instruments, respondents were asked whether:

- the instrument influenced them to carry out energy saving measures that they would not have carried out without the instrument,
- the instrument influenced them to carry out more energy saving measures than they originally planned because of the instrument
- the instrument influenced them to carry out measures earlier than they planned.

81% of respondents who used the renewable technology subsidy were positive about the influence and 74.5% of those who used the Meer met Minder subsidy found it to be influential, see figure 3.3. Meanwhile 67% and 63% of respondents who used the high performance glass subsidy and VAT reduction stated that this influenced their energy saving investment, see figure 3.3. The renewable technology and Meer met Minder subsidies appeared as the most influential financial instruments according to respondents, see figure 3.5 and 3.6



FIGUR E 3.3 Influence of financial instruments

The most influential aspect of all instruments was that they stimulated the earlier adoption of measures see figures 3.4 to 3.7. An important theory behind financial instruments is that they stimulate 'additional' energy saving improvement see Murphy et al. 2012 (Chapter 2). Instruments depicted above were moderately successful in this regard with the subsidy for renewable technology being the strongest at 60%. The renewable technology subsidy was most influential at stimulating the adoption of a measure that would not have been adopted without the subsidy, another important theory of financial instruments (ibid). The reduced VAT appears as one of the weaker financial instruments which confirms with this instrument being implemented primarily as a tool to stimulate the building sector more than an energy saving initiative per se (ibid).

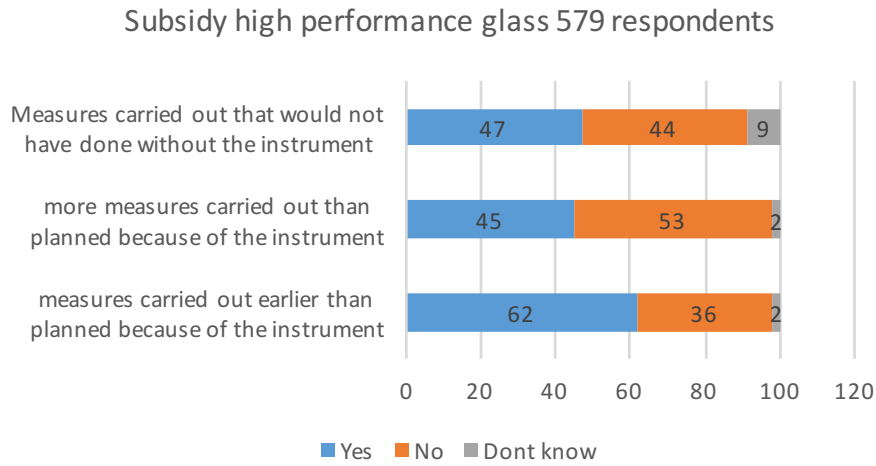


FIGURE 3.4 Detailed influence of glass subsidy

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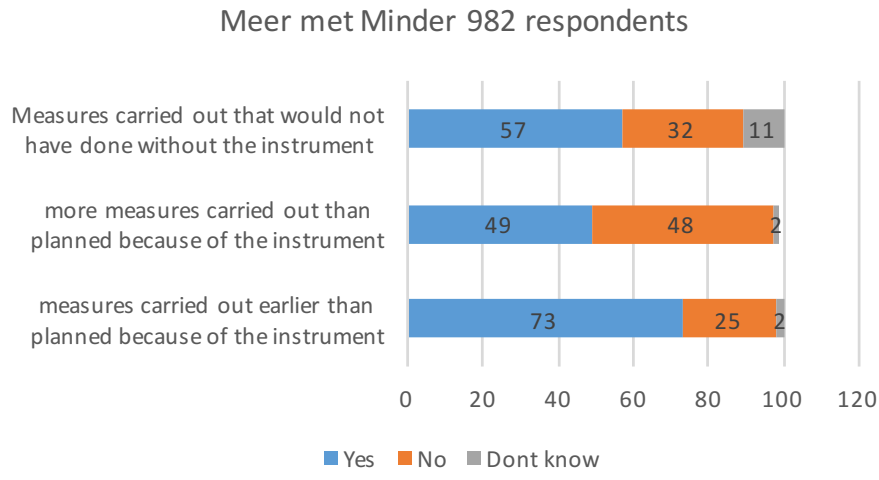

FIGURE 3.5 Detailed influence of MmM subsidy

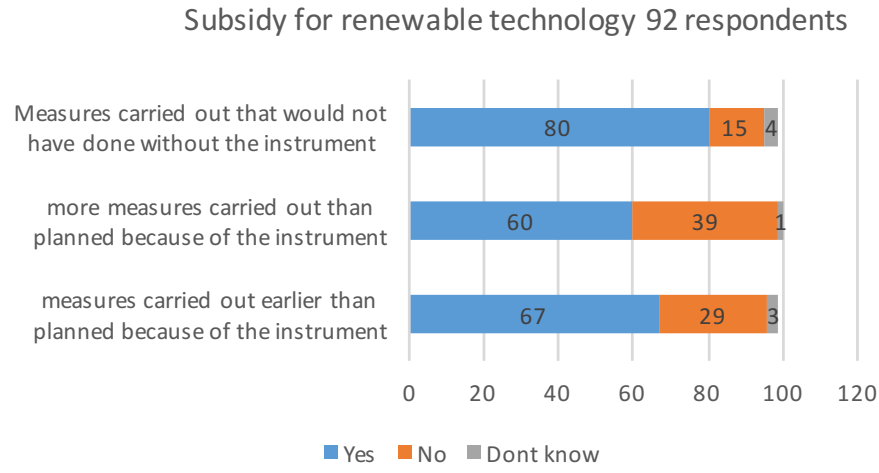

FIGURE 3.6 Detailed influence of renewable technology subsidy

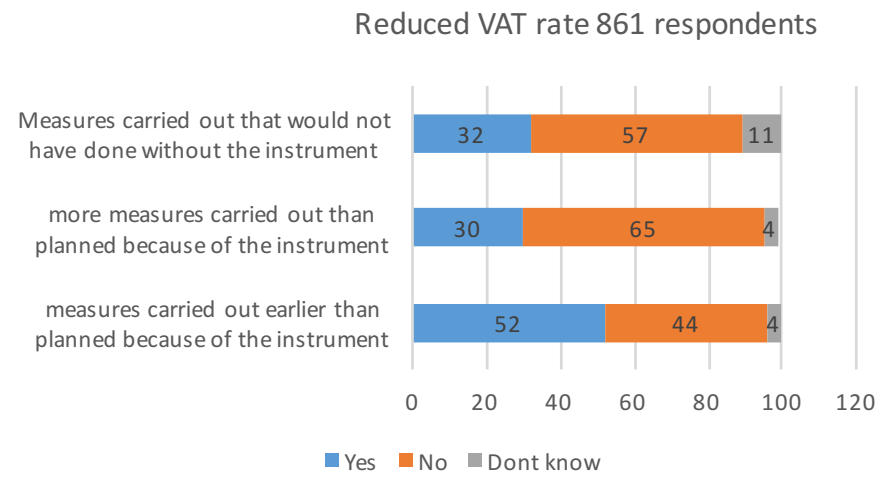

FIGURE 3.7 Detailed influence of reduced VAT

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§ 3.4.2 Statistical: Influence of dwelling and household characteristics on energy saving measures

Pearson's chi square tests showed that households living in detached dwellings were most active in adopting energy saving measures while those living in apartments and terraced dwellings were less active. An association between the age of the dwelling and the adoption of energy saving measures was identified with households living in older dwellings more likely to have adopted measures.

Meanwhile, results showed that one-person households were less likely to have adopted energy saving measures. An association between the age of the household and the adoption of measures was identified with the over 80s less likely to have adopted measures and the 40-65 age group more likely.

Households who lived in their dwellings for less than one year were less likely to have adopted energy saving measures and those with plans to move within a year were also less likely to have adopted measures. Interestingly, average, above average and high-energy users were expected to adopt measures more than they did although individually standardised residuals were not significant. No association between adopting energy saving measures was identified for the household characteristics of education, employment or income.

§ 3.4.3 Influence of instruments

Pearson's chi square tests were conducted to test for the association between adopting energy saving measures and using national policy instruments and information sources. A significant association was found for all instruments except for the energy tax and the EPC.

§ 3.4.4 Influence of dwelling & household characteristics on quantity of measures adopted

A further interest was to test the association between variables and the quantity of energy saving measures undertaken; measures were grouped into 3 categories: 1-2 measures, 3-5 and 6-9 measures. Analysis was run on the 3829 respondents who took some form of energy saving measure.

No statistical significant association was identified between dwelling type and the quantity of measures adopted. However, a significant association was identified between dwelling age and the quantity of measures adopted with dwellings constructed before 1945 more likely to be subject to 6-9 measures and dwellings constructed between 1945 and 1970 more likely to be subject to 3-5 measures.

Statistically significant associations were identified between most household characteristics and the quantity of energy measures adopted except for household education, income and energy use. Larger households were more likely to carry out more measures than smaller households and younger householders were more likely to carry out more measures than older households.

Households in full-time employment were observed to carry out more measures than expected while retired households were observed to carry out 1-2 measures more than expected. Households living in their dwelling for 1-5 years were more likely to carry out a greater quantity of measures while those planning on moving within 1-5 years were less likely to carry out greater quantities of measures.

§ 3.4.5 Influence of instruments on quantity of energy saving measures adopted

A statistically significant association was identified between the use of instruments listed below and the quantity of energy saving measures adopted:

- Meer met Minder subsidy
  (a performance based subsidy linked to the EPC rating)
- High performance glazing subsidy
- VAT reduction
- Building permit
- EPC
- Interactive web-pages

– Information from: the Home Owners Association, Builders/Installers, Meer met Minder and the National Environmental Consumer Organisation

The standardised residuals were statistically significant across all categories. The remaining financial instruments (subsidy for an energy audit, special loan and micro-generation technology subsidy) also showed that households who used these instruments were more likely to carry out more measures but standardised residuals were not always statistically significant across all categories.

The energy audit proved an interesting exception as a significant association existed but the opposite to that assumed i.e. households without an energy audit actually adopted 6-9 measures more than expected and households with an energy audit adopting 6-9 measures less than expected. Similarly, householders who made contact with their energy company were more likely to adopt 1-2 measures and less likely to adopt 3-5 and 6-9 measures. In this case the likelihood of adopting 6-9 measures was statistically significant.

§ 3.5 Links to other research

Results are largely in keeping with research results presented in section 3.2.3. Householder age and size were found to be significant for energy retrofitting but income was not. The lack of significance of income may be related to the sample selection consisting purely of owner-occupiers which is possibly more homogeneous than other survey results. As with other research results, education and occupation were not associated with adopting measures although householders with occupants in full time employment were found to carry out a greater number of energy saving measures. Energy measures were associated more with detached dwellings than apartments and terraced dwellings as well as with older dwellings.

As with other research the main reasons for carrying out energy saving measures were to reduce energy bills and to improve comfort. The main reason for not carrying out energy saving measures was that dwellings were considered energy efficient. This diverged from the cost barrier which is the most frequently cited reason from other research.

Results largely mirrored the top down evaluation presented in Murphy et al. 2012 (Chapter 2) and research in this area. The energy tax was found to have little influence both according to respondents and statistical tests with less than half of the sample even aware of its existence. Likewise, energy saving loans were not popular with use

of individual loans too low for statistical analysis. Similarly, the criticisms of the EPC by stakeholders were supported by the survey results showing that this instrument was not associated with the adoption of energy saving measures with a low 27% of respondents describing the EPC as an influence.

Some divergence from the top down evaluation presented in chapter 2 was found with information tools. These instruments were scarcely considered by stakeholders in the overall repertoire of tools promoting energy efficiency. However, contact with national organisations promoting energy efficiency emerged as one of the most influential instruments from the household survey with 60% of householders describing this as an influence in their energy efficiency investments. This positive result points to the opportunity that these information sources hold to promote deep retrofit and raise awareness of other instruments. An exception was contact with energy companies which was not associated with deep retrofit.

Another exception to previous research and to results from the top down evaluation was that the energy audit was found to deviate from its intended impact of influencing deep retrofit. Householders in possession of this instrument were found less likely to carry out an increased number of measures. This finding may have some relevance to the finding of Frondel and Vance (2012), that recipients decide not to invest in measures on the basis of audit information, especially if investment cost is 'over emphasised' (Magat et al., 1986).

Research results support findings that promote performance based subsidy schemes (Rosenow and Sagar, 2015). The Meer met Minder subsidy with a link to the energy audit was the only performance based subsidy available at the time of the survey and relative to other subsidies it showed positive results. As shown in figure 3.5, 57% of respondents who found the instrument influential would not have carried out energy saving measures without the instrument and 49% carried out more measures than they planned because of the instrument.

§ 3.6 Conclusions and recommendations

The central research question of this research component is: does an association exist between the use of national policy instruments and the adoption of energy saving measures? Statistical tests show that the majority of instruments available to owner-occupiers at the time of the survey were associated with the adoption of energy saving measures. Notable exceptions were the EPC and energy tax. When respondents were asked directly about the influence of instruments information sources appeared the

most influential at 60% followed closely by financial instruments at 57%. While these percentages represent a majority in both cases they are not overwhelming. Therefore, a large portion of the sample used instruments but considered them of weak or no effect. The title of this chapter asked "do energy performance policy instruments work on owner occupiers" the answer, yes, but not at the level of 'transforming', 'achieving zero' or 'deep retrofit' that climate change policy and targets demand.

Research results highlight the need for a more sophisticated framework for the development and design of instruments that goes beyond the barrier and market transformation models. Models that truly understand and capture the behavior of householders is required. This is evidenced in this research by the many nuances surrounding household investment behavior such as the fact that the main reason for not retrofitting among survey respondents was not a typical barrier but an understanding of adequate dwelling energy efficiency. The behavior of householders in actual energy use is garnering greater attention in research and policy. The actual rather than theoretical behavior of householders with policy instruments is equally in need of greater attention. It is the decisions of householders that will determine whether energy saving targets will be met and yet a wealth of nuances and unknowns surround these decisions.

Results from here and other research strongly suggest that a rethink is required about the instruments used to promote energy efficiency among owner-occupiers. "The understanding shared by policy makers and practitioners of how energy efficiency can and should be improved is deeply institutionalized, and continually reproduces similar portfolios of policies" (Wilson et al., 2015: 19). This statement rings through for research presented here. Many of the same information tools and single stand alone subsidies, taxes and loans continue to form the main policy response to meet climate change targets. Research here shows that the influence of single stand alone instruments is much weaker than a performance based subsidy linked to an information instrument, for example the difference between the high performance glass subsidy and reduced VAT rate compared to the Meer met Minder subsidy. Many of the findings from research presented here support the policy recommendations of Boardman (2012) and Rosenow and Sagar (2015) that regulatory standards may have a role to play in the owner occupied stock. Rosenow and Sagar (2015) suggest eliminating the lowest energy rated dwellings with a gradual increase in standards. Results from this research that high energy users were also reticent in adopting measures suggest that the regulatory arm could extend to energy use perhaps through a properly functioning polluter pays energy tax.

Research presented here hints at the variety and complexity of inter-relating factors that come in to play in a householder's decision to invest in energy saving measures. Research is adding knowledge to these factors constantly. There remains however much scope for further investigation and deeper analysis of these factors. Further

research could examine the extent to which policy instruments were decisive in adopting energy saving measures. Many respondents to the survey used in this research component consented to be contacted for future research. The scope herein is great including the possibility to conduct face to face interviews with householders to gain greater understanding of their action and experiences. Deeper analysis of the inter-relationships between instruments and variables will enrich understanding of the energy efficiency gap and methods to close it.

Within such a robust long term policy strategy there would need to be a secure place for a sophisticated means of monitoring and evaluating instruments. Results showing that the energy audit among this survey sample was not associated with deep retrofit points to the need for constant evaluation to ensure that instruments remain true to their intended consequences and to understand the factors at play if they are not. That many instruments included in this survey were rehashed versions of instruments that have been operating for decades in the western world with questionable results shows some serious flaws in this policy domain. A culture of robust evaluation could improve this.

References

Abrahamse, W. et al., 2005. A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology* 25:273-291.

Adjei, A. et al., 2011. 'Deliverable 5.2 A Study of Homeowners' Energy Efficiency Improvements and the Impact of the Energy Performance Certificate. Appendix B-G'. Available at http://ideal-epbd.ed, (accessed May 2011).

Alberini, A. et al., 2014. Looking for free riding: energy efficiency incentives and Italian homeowners. *Energy Efficiency* 7: 571-590.

Allcott H. and Mullainathan S., 2010. Energy Behavior and energy policy. *Science*: 327(5970):1204-5.

Bartiaux, F. et al., 2014. A practice-theory approach to homeowners' energy retrofits in four European areas. *Building Research and Information* 42(4): 525-538.

Birkland, T.A., 2005. *An Introduction to the Policy Process: Theories, Concepts and Models of Public Policy Making*. M. E. Sharpe, Armonk/London.

Blumstein, C., Krieg, B., Schipper, L and York, C., 1980. Overcoming social and institutional barriers to energy conservation. *Energy*, 5, 4, 355–371.

Boardman, B., 2012. 'Achieving Zero: delivering future-friendly buildings'. Available from: http://www.eci.ox.ac.uk/research/energy/acheivingzero. (accessed Septemeber 2012).

Brounen, H. and Kok, N., 2010. 'On the Economics of the EU Energy Labels in the Housing Market'. Available at http://www.joinricsineurope.eu, (accessed March 2011).

Bruel, R. and Hoekstra, J., 2005. 'How to stimulate owner-occupiers to save energy'. Proceedings of ECEEE 2005 Summer Study Energy savings: What Works & Who Delivers? 30 May – 4 June 2005, Mandelieu La Napoule, France.

BZK, 2011. 'Plan van Aanpak Energiebesparing Gebouwde Omgeving'. Available at: /http://www.rijksoverheid.nlS (accessed June 2011).

CBS (Centraal Bureau voor de Statistiek), 2010. 'Statistisch jaarboek 2010'. Available at: http://cbs.nl (accessed September 2012).

CBS, 2011. 'Bijna 16 procent van de in 2010 verkochte woningen heeft energielabel, Artikel, maandag 23 mei 2011'. Available at: /http://www.cbs.nl/nl-NL/menu/themas/bouwen-wonen/publicaties/artikelen/archief/2011/2011-verkochte-woningen-met-energielabel-pub.htmS (accessed May 2011).

CBS, 2012. 'Welvaart in de afgelopen decennia opgelopen'. Persbericht PB12-031 14 mei 2012. Available at: http://cbs.nl, (accessed September 2012).

CIA 2012, 'Europe: Netherlands' The World Factbook. Available at https://www.cia.gov. (accessed September 2012).

Collins, J. et al., 2003. 'Carrots, Sticks and Sermons: Influencing Public Behaviour for Environmental Goals'. A Demos/Green Alliance Report Produced for Defra. Available from http://www.green-alliance.org.uk (accessed March 2010).

Curtain, J. and Maguire, J., 2011. 'Thinking Deeper: Financing Options for Home Retrofit'. Available from: http://www.iiea.com/publications/thinking-deeper-financing-options-for-home-retrofit. (accessed September 2012).

Curtis, F.A., Drever, S. and Simpson-Housley, P., 1984. Communications on Energy: Household energy conservation. *Energy Policy* 12, 4, 452-456.

De T'Serclaes, P., 2007. 'Financing Energy Efficient Homes: Existing policy responses to financial barriers'. OECD/IEA, Paris.

Delhagen, E. et al., 2009. 'Scaling up Building Energy Retrofitting in U.S. Cities. A Resource Guide for Local Leaders'. Available from: http://www.iscvt.org/ (accessed September 2012).

Dillman, D.A., Rosa, E.A and Dillman, J.J., 1983. Lifestyle and Home Energy Conservation in the United States: The Poor Accept Lifestyle Cutbacks While the Wealthy Invest in Conservation. *Journal of Economic Psychology* 3, 3–4, 299–315.

ECN, 2010. 'Reference Projection Energy and Emissions 2010–2020'. Available at: /http://www.ecn.nl/publications/Default.aspxS (accessed December 2010).

Eurostat, 2009. 'Labour Market Statistics'. Available from: http://www.europa.eu. (accessed September 2012).

Eurostat, 2015. 'Housing Statistics'. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Housing_statistics. (accessed September 2015).

Field, A., 2009. *Discovering Statistics Using SPSS* (3rd ed.). Sage, London.

Frederiks, E.R. et al., 2015. The Socio-Demographic and Psychological Predictors of Residential Energy Consumption: A Comprehensive Review. *Energies* 2015, 8, 573-609.

Frondel, M. and Vance, C., 2012. 'Heterogeneity in the Effect of Home Energy Audits: Theory and Evidence'. Available from: http://en.rwi-essen.de/publikationen/ruhr-economic-papers/461/ (accessed September 2013).
Gram-Hanssen, K., Bartiaux, F., Jensen, M.O. and Cantaert, M., 2007. Do homeowners use energy labels? A comparison between Denmark and Belgium. *Energy Policy* 35, 5, 2879-2888.
Hamilton, B., et al., 2010. 'A Comparison of Energy Efficiency Programmes for Existing Homes in Eleven Countries'. Available at: /http://www.raponline.org/Feature.asp?select=144S (accessed September 2010).
Hayes, S., Nadel, S., Granda, C. and Hottel, K., 2011. 'What have we learned from energy efficiency financing programs?' American Council for an Energy Efficient Economy, Washington.
Herring, H., Caird, S. and Roy, R., 2007. 'Can consumers save energy? Results from surveys of consumer adoption and use of low and zero carbon technologies'. In: European Council for an Energy Efficient Economy Summer Study 2007, 4-5 June 2007, La Colle sur Loup, Côte d'Azur, France.
Hirst, E and Goeltz, R., 1985. Estimating Energy Savings Due to Conservation Programmes: The BPA Residential Weatherization Pilot Programme. *Energy Economics* 7, 20-28.
Jaffe, A.B. and Stavins, R.N., 1994. The energy-efficiency gap: What does it mean? *Energy Policy* 22, 10, 804-810.
Joosen, S., et al., 2004. 'Evaluatie van het klimaatbeleid in de gebouwde omgeving 1995–2002'. Available at: /http://www.ecofys.nl/nl/publicaties/evaluatie_kli maatbeleid_gebouwde_omgeving_1995_2002.aspS (accessed January 2011).
Magat, W.A., Payne, J.W. and Brucato, P.F., 1986. How Important is Information Format? An Experimental Study of Home Energy Audit Programs. *Journal of Policy Analysis and Management* 6, 1, 20-34.
Ministry of Economic Affairs, 2014. 'National Energy Efficiency Plan-the Netherlands'.
Murphy, L., Meijer, F and Visscher H. 2012. A qualitative evaluation of policy instruments used to improve energy performance of existing private dwellings in the Netherlands. *Energy Policy* 45:459–468.
Murphy, L. 2014a The influence of energy audits on the energy efficiency investments of private owner-occupied households in the Netherlands. *Energy Policy* 65 398-407.
Murphy, L. 2014b. The influence of the Energy Performance Certificate: The Dutch case. *Energy Policy* 67:664-672.
Murphy, L. 2014c. The policy instruments of front-runners: effective for saving energy in existing dwellings. *Energy Efficiency* 7: 285-301.
Nilsson, H. and Wene, C.O. 2011. 'It is not the barriers, but the disorganised learning that holds us back'. ECEEE 2011 Summer Study-Energy Efficiency First-The Foundation of a Low Carbon Economy.
Pelenur, M.J and Cruickshank, H.J., 2014. 'Motivations to Adopting Energy Efficiency Measures in the Home'. Proceedings of the Institution of Civil Engineers. Available from http://dx.doi.org/10.1680/ener.14.00013 (accessed September 2015).
Pettifor, H. et al., 2015. The appeal of the green deal: Empirical evidence for the influence of energy efficiency policy on renovating homeowners. *Energy Policy* 79:161-176.
Pfaffenberger, M., Meyer-Renschhausen, M. and Hohmeter, O., 1983. Energy Conservation by Private Households in the Federal Republic of Germany: The Efficacy and Distributional Effects of Energy Policy. *Journal of Economic Psychology* 3, 285-298.
Risholt, B. And Berker, T., 2013. Success for energy efficient renovation of dwellings-Learning from private homeowners. *Energy Policy* 61:1022-1030.
Rosenow, J., 2012. Energy Savings Obligations in the UK-A History of Change. *Energy Policy* 49, 373–382.
Rosenow, J. and Sagar, R., 2015. 'After the Green Deal: Empowering people and places to improve their homes'. Available from http://www.respublica.org.uk, (accessed September 2015).
Sardianou, E., 2007. Estimating energy conservation patterns of Greek households. *Energy Policy* 35, 3778-3791.
Scott, F. Et al., 2014. What do people living in deprived communities in the UK think about household energy efficiency interventions? *Energy Policy* 66:335-349.
Shove, E., 1998. Gaps, barriers and conceptual chasms: theories of technology transfer and energy in buildings. *Energy Policy* 26, 15, 1105-1112.
Stern, P.C., et al., 1986. The effectiveness of incentives for residential energy conservation. *Evaluation Review* 10, 147–176.
Stieß, I. and Dunkelberg, E., 2013. Objectives, barriers and occasions for energy efficient refurbishment by private homeowners. *Journal of Cleaner Production* 48: 250-259.

Sutterlin, B, Brunner, T and Siegrist, M., 2011. Who puts the most energy into energy conservation? A segmentation of energy consumers based on energy-related behavioural characteristics. *Energy Policy* 39, 12, 8137–8152.

Weber, L., 1997. Viewpoint: some reflections on barriers to the efficient use of energy. *Energy Policy* 25 (10) 833-835.

Weiss, J., Dunkelberg, E. and Vogelpohl, T., 2012. Improving policy instruments to better tap into homeowner refurbishment potential: Lessons learned from a case study in Germany. *Energy Policy* 44, 406-415.

Wilhite, H. Shove, E., Lutzenhiser, L and Kempton, W., 2000. 'The legacy of twenty years of energy demand management: we know more about individual behaviour but next to nothing about demand'. In E. Jochem et al (eds) Society, Behaviour and Climate Mitigation. Kluwer Academic Publishers, the Netherlands: 109-126.

Wilson, C., Cranea, L. and Chryssochoidis, G., 2015. Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy. *Energy Research and Social Science* 7:12–22.

Wirtshafter, R.M., 1985. Non-participants in utility energy conservation programmes. *Energy Policy* 13 (2), 143–155.