

5 The influence of the Energy Performance Certificate: The Dutch case

Abstract

All European Union Member States require an Energy Performance Certificate (EPC) when buildings are constructed, sold and rented. At its introduction the EPC was considered a pioneering instrument, one that would help overcome an information deficit hindering consumer interest in energy efficient dwellings. Now that the EPC has been implemented for several years it is possible to examine its impact. This research draws on data from ex-ante and ex-post assessments of the EPC in a number of countries and presents the results of a survey of Dutch private dwelling purchasers. This survey was based on two sample populations, one received an EPC during property transaction and another did not. Differences were sought between the two samples in a number of areas relating to the adoption of energy efficiency measures. Results show that many projections about the impact of the EPC have fallen short. The EPC was found to have a weak influence, especially pre-purchase. The potential of the EPC in driving energy efficiency improvement in the existing stock is doubted especially if it continues to act independent from a mix of instruments designed to tackle multiple barriers. It is argued that the energy saving potential of existing dwellings, applauded in climate change policy, will remain unexploited if it continues to be assessed subjectively by householders.

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§ 5.1 Introduction

The EPC was introduced as a requirement for European Union Member States by the Energy Performance of Buildings Directive 2002 (recast 2010) with most Member States requiring the EPC by 2008. The EPC assigns a building a rating based on the energy efficiency of the thermal envelope and installations. Ratings range from A to G, A being the most efficient. Alongside this, the EPC can contain recommendations

showing what energy efficiency improvements are possible and in some cases what corresponding cost savings can be expected.

At its debut the EPC was considered a pioneering instrument. The European Commission (EC) heralded it as “a powerful tool to create a demand-driven market for energy efficient buildings... allow[ing] economic agents to estimate costs in relation to energy consumption and efficiency” (EC, 2008, p. 5). The outreach capacity of the EPC formed an appeal to some commentators as: “arguably the most commonly available and accessible source of advice to home sellers and buyers about the sorts of improvements that could help save both cash and carbon” (NHER, 2009). Similarly, “the certificate provides a unique opportunity to formulate individual action proposals for each house and each property owner” (SOU, 2008, p. 66). Other statements show that the EPC was expected to play a significant role in market transformation because it “sends a powerful message to homeowners, the construction industry and appliance suppliers alike. It empowers consumers to factor in energy efficiency as part of their decision to buy a particular property and to understand better how they can have control over the energy performance of their home (by consumption patterns and home improvements). Construction and appliance suppliers will have to respond to the needs of better-informed consumers” (cited in Parnell and Popovic Larsen, 2005, p. 1093).

The bold statements of early policy responses have yet to come to fruition. Implementation issues and a lackluster response from buyers and sellers in many European Member States means that the EPC is not the empowering tool leading the charge to market transformation that was expected (Laine, 2011; Watts et al., 2011; Amecke, 2012; Backhaus et al., 2011).

The aim of research presented here is to comprehensively assess the EPC in the Netherlands. It is possible to piece together different aspects relating to how the EPC functions, pre and post purchase, from research projects in various European countries. In this research how the EPC functions across all aspects, pre and post purchase is assessed in depth for one country. Moreover, the lack of an enforcement regime for the EPC in the Netherlands at the time of research allowed for recent homeowners with an EPC to be compared to recent homeowners without an EPC, an important dimension to understanding the effectiveness of the EPC that has not been previously reported. As well as assessing the differences in terms of energy saving measures adopted and planned the reasons why homeowners did not have an EPC at the time of purchasing their property was assessed.

§ 5.2 Barriers, behaviour and instruments

The persistent failure of many households to carry out cost effective energy saving measures in their dwellings has enjoyed attention for several decades (Gates, 1983; Jaffe and Stavins, 1994; Curtain and Maguire, 2011). Research shows that households behave differently to rising energy prices and to public campaigns to reduce energy use depending on large range of variables including income, age, location, the energy saving measures being promoted, the information at their disposal and their personal norms and values (Poortinga et al., 2003; Martinsson et al., 2011). Some of the more consistent and alterable variables such as financial ability and information are linked to the 'barrier-model' of developing instruments.

The barrier model theorises that householders do not capitalise on opportunities to improve the energy efficiency of their dwellings because of well-rehearsed obstacles including but not limited to difficulties in meeting the upfront costs of energy saving measures, hassle and lack of trusted information (Blumstein et al., 1980; Shove, 1998; Weber, 1997). The EPC can be viewed as a reaction to the information deficit barrier. Its application at the property transaction point appears during an important natural moment that could aid market transformation by driving sellers to improve their property or potential buyers to negotiate on the basis of a poor EPC rating. Furthermore, it provides information on energy saving measures that could be applied post-purchase.

However, the apparent logic of the barrier model and the instruments formulated in response can clash with research applied to decipher household attitudes and behaviour at a deeper level. Collins et al. (2003, p. 25), for example, are highly critical of the way some information tools are formulated and perceived to operate: "Eco-labelling is perhaps the best example of a policy which relies on a naïve conceptualisation of human behaviour. The assumption is that information drives action-all the available evidence suggests that this is a false assumption: people do not purchase in a rational, information seeking way". The barrier model is also subject to criticism because of its simplicity. Instead of developing instruments in reaction to specific barriers Blumstein et al. (1980) and Shove (1998) have called for greater understanding of the nature, variation and interaction of barriers across time, space and different households. This sentiment is echoed in segmentation models of populations based on their resources, attitudes and propensity to act on their knowledge and beliefs. These models consistently show that householders make up such a rich tapestry that 'one size fits all' instruments will simply miss the target (Vringer et al., 2007; Egmond et al., 2006; Sutterlin et al., 2011).

A range of literary sources confirms that the conceptual pillar of many instruments – the rational, information seeking individual – is a minority. Thaler and Sunstein

(2008) call this minority Econs, whereas the majority of people are Humans, led by emotion and often the agents of poor decisions that defy economic logic. This division in how populations react also has a home in diffusion research. There are innovators and laggards and in between a great majority (Rogers, 2005). Diffusion and market transformation literature cajoles that once the great majority is reached, goals come into sight and policy efforts pay off. Gladwell (2002) calls this the tipping point. How this tipping point can be reached and the types of interventions that can lead to it are surrounded by uncertainty and complexity.

Some pointers are offered by theories from marketing, economic behaviour, psychology and diffusion in the promotion of a combined instrument approach. Stern (2000, p. 419) notes that “since different individuals face different impediments to behaviour change and the impediments are often multiple, little happens until the right combination of interventions is found”. A communication instrument like the EPC is especially considered in need of companions, “communication instruments can be useful when it comes to addressing information problems, but they are generally considered to be supplementary policy instruments, not substitutes for economic or regulatory instruments” (cited in Sunikka, 2006). Stern (1999) echoed this statement finding that information alone, depending on careful design and delivery, could change certain kinds of environmentally significant consumer behaviour to a modest extent. He found that there was little to no effect of information tools when there are other barriers external to the individual such as financial barriers and inconvenience. A number of research projects on perceived and actual impact of the EPC illustrate some of the aforementioned concepts and complexities.

§ 5.3 Previous research

A clear divergence between ex-ante and ex-post research on the EPC exists. Ex-ante results show restrained positivity towards the EPC but with a repeated caveat that it must be embedded in a wider framework of instruments. Sunikka (2006) termed it a “first step towards influencing consumer preferences”. Likewise, Parnell and Popovic Larsen (2005) state that it is a positive first step but that improvement would be needed to ensure effectiveness and that it would need to be embedded in a wider programme of domestic energy efficiency support. The results of a European project BELAS which involved the critical appraisal of then extant variants of the EPC in participating Member States concluded that for the EPC to be successful it must be “‘pushed’ by institutional users, or ‘pulled’ by government”. They went on to say, “Energy labelling, when integrated into a well-designed overall approach and programme, can contribute to inciting energy saving investments” (BELAS, 2001).

The results of another European project IMPACT came to similar conclusions and it was put forward that recommendations in the EPC could form a basis for other policy instruments (IMPACT, 2005).

Other ex-ante assessments showed that the EPC could expect a warm welcome on the property market. In the UK, in a sample of over 2000 individuals, 78% stated that it would be important to look at the EPC rating before buying and 70% stated that they would consider re-negotiating the property price if they discovered it was highly energy inefficient (EST, 2008). The European project IDEAL EPBD found that in a survey of over 3000 European households 60% mentioned expected utility costs as important in a purchasing decision while 40% mentioned the type of heating system. When asked directly about energy efficiency results were weaker with 14% of a UK sample stating that energy efficiency would be a factor in purchasing a property (Laine, 2011). Surveys show that energy efficiency, however valued by householders, is consistently topped by the heavyweights and 'unalterables' of location, size and price.

Furthermore, ex-ante reports suggested that between 18% and 46% of households could be expected to act on recommendations in an EPC post-purchase (IMPACT, 2005). The IMPACT study showed that in a sample of householders in Germany 40% of owners and landlords stated that the EPC prompted renovation activity. In the same study, 27% of the Dutch sample stated that, on the basis of the EPC, they intended to implement measures within the year with 18% not having this intention before receiving the EPC. These samples were small, less than 100 households, so could not be generalised. Similarly, in a survey of 256 householders who received a precursor to the EPC, 46% stated that they intended to carry out at least one of the recommendations during that year (Parnell et al., 2002). Whether they were already planning on implementing a recommendation without the EPC was not analysed.

Ex-post assessments display differences between the stated and revealed preferences of householders, especially pre-purchase. While EST (2008) found in their ex-ante assessment that 70% of a sample in the UK would negotiate price on the basis of a low EPC rating, Laine (2011) found, from a survey of a similar sample size in the UK, that 18% actually used it as part of negotiation. Watts et al. (2011) also found on the basis of responses from approximately 200 households that the EPC had little impact on price negotiation in the UK. A study in Germany based on 662 respondents concluded that "the EPC is only a moderately effective information instrument for helping purchasers to incorporate energy efficiency into their purchasing decisions" (Amecke, 2012, p. 8). Amecke (2012) also concluded that energy efficiency is diminished by factors like price, location, and outdoor space. The largest ex-post European wide study of the EPC, IDEAL EPBD, came to bleak conclusion that the EPC plays a minor, if any, role in homeowners decision-making (Backhaus et al., 2011).

On the basis of qualitative interviewing Laine (2011) uncovered some explanation for the gap between the hypothetical and actual reality of buying a dwelling with a poor EPC rating. Interviewees discussed the stress of property purchase and the fear of losing out if appearing difficult. Moreover, improvement works and energy saving measures were more commonly accepted as activity carried out post-purchase (ibid). This corresponded to a finding by Gram- Hanssen et al. (2007) based on qualitative interviews with 10 Danish households which found that the EPC is not used in the decision of buying a dwelling but in what to do with it post-purchase.

A number of ex-post studies have examined the post-purchase impact of the EPC in different EU countries. The precise role of recommendations in the EPC is difficult to isolate from the background noise of other influences and variables. NHER (2009) attempted to identify the role of EPC recommendations among UK householders through a phone survey of 302 EPC recipients and analysis of over 300,000 EPCs. They found that 32% of households surveyed had implemented some energy saving measures and 9% intended to. Loft insulation was the most commonly installed measure but improvements to the heating system was the most recommended measure showing a mismatch between the most frequently recommended measure compared to the most frequently adopted measure. A study in Denmark noted that over 45% of householders with EPCs stated that they had implemented energy savings in the first year but a cause and effect relationship with the EPC was not identified (Laustsen and Lorenzen, 2003). Another Danish study based on phone interviews of 300 households with an EPC and 300 without identified a difference in investment priorities between households with an EPC and those without. In this case, households with an EPC were subject to deeper energy efficiency measures but the difference was noted as 'almost statistically insignificant' (cited in Kjaerbye, 2008). Results from the IDEAL EPBD project also identified an impact of EPCs post-purchase. Householders with EPCs with recommendations were twice as likely to have carried out energy saving measures compared to those without recommendations or unaware of their EPC (Tigchelaar et al., 2011, p. 6).

The reasons why householders act on recommendations or undertake energy saving measures frequently relate to, inter alia, comfort, desire to save money and environmental concern (Bruel and Hoekstra, 2005). The reasons for not acting range from lack of finances and time to uncertainty about the length of time householders plan to live in a particular dwelling (ibid). Two studies have pointed to an interesting finding on why householders may not follow the recommendations listed on their EPCs. Tigchelaar et al. (2011, p. 8) noted that almost 40% of Dutch householders did not trust EPC recommendations. Likewise, the NHER (2009) found that the main reason for not acting among their sample was that householders did not agree with recommendations.

Brounen and Kok (2010) examined the impact of the EPC using a different approach from the bottom up surveys of the stated and revealed preferences of householders described above. They carried out a large statistical study using the EPC database, a large real estate database and economic and voting data in the Netherlands. They found that houses with an A, B or C rating enjoyed a 2.8% price premium. In addition, they found that EPCs were more popular in less competitive housing areas of high-density and low average monthly incomes in areas of 'green' political sympathies. The authors concluded that the EPC represents a "moderately powerful market signal". While survey data shows that the EPC fails to have a direct influence during negotiation and decision making the Brounen and Kok (2010) study shows that a higher EPC plays an indirect positive role. This study is comparable to an Australian study that found a statistically significant relationship between energy efficiency as displayed in an energy rating and house price (Department of the Environment Water Heritage and the Arts, 2008).

§ 5.4 Methodology

§ 5.4.1 Context

The EPC was introduced in the Netherlands in 2008 with a revised version introduced in 2010 with the requirement that, inter alia, recommendations be included. In the Netherlands an EPC should accompany a dwelling (constructed more than ten years ago) when it is sold or rented. Initially the EPC was reasonably well accepted with two thirds of dwellings on the market complying with the requirement (Milieu Centraal, 2009). However, public acceptance plummeted in its initial year after a consumer programme showed the same dwelling obtaining several different EPC ratings. Added to this, the EPC was not introduced with an enforcement regime. Commonly, it would be stated in property advertisements that an EPC was 'unavailable' or 'not applicable'. Effects of the negative publicity and lack of enforcement became clearly manifest in 2010 when 10% of dwellings were sold with an EPC, this climbed to 16% in 2011 (CBS, 2011).

§ 5.4.2 Survey design and distribution

To comprehensively assess the role of the EPC, as well as the complete range of instruments that households in the Netherlands are exposed to, an online questionnaire consisting of 96 questions was created in 2012. The questionnaire consisted of multiple choice and open ended questions divided into several categories: the adoption and planned adoption of energy efficiency measures, the EPC, energy audit, building regulations, the energy tax, financial incentives, information tools and socio-economic and dwelling characteristics.

Required sample sizes were calculated on the basis of assumptions and several critical components of the questionnaire that required a set response rate to allow statistical comparison (See Appendix 2). Slightly less than 30,000 questionnaires were sent to households in the EPC database. The EPC database contains households with an EPC because they bought a dwelling, rented a dwelling or because they had an energy audit carried out (an EPC is included in official energy audits). It was assumed that the majority of registrations would have an EPC because they received an energy audit. Therefore, a large sample size was required to capture householders with an EPC because of the property transaction process.

To create the comparison sample over 16,000 members of the Association of Home Owners, who recently purchased their dwelling, were sent an email with a link to the questionnaire. The Association of Home Owners represents the interests of 17.5% of Dutch homeowners (VEH, 2012). As this is a fee-paying members based organisation it is assumed that they are not entirely representative of the Dutch population. However, accessing data of recent and representative dwelling purchasers was restricted. Associations managing real estate data and mortgage data would not permit the use of contact details due to privacy issues. The National Land Registry would issue only a limited number of addresses, which would not have allowed for statistical analysis.

Following a reminder, a response rate of 17% was received for the EPC database and 10% for the Association of Home Owners. After splitting respondents into various groups for further analysis and removing inconsistent cases, the final count for sample populations discussed here is 297 for recent dwelling purchasers with an EPC and 1027 for those without.

§ 5.4.3 Analysis

Firstly, some key characteristics of the sample groups, considered as influential factors in the adoption of energy efficiency measures were analysed. Characteristics are divided into dwelling related (dwelling type and age) and household related (size, age, education, employment, income, duration of occupation and plans to move dwelling). As variables are categorical and the aim was to determine differences Pearson's chi-squared tests were conducted following the procedures described by Field (2009).

A second stage of analysis involved examining the influence of the EPC and contextual aspects of investment behaviour as reported by recipients. Why respondents came to possess an EPC or not and the influence of the EPC pre and post-sale are described in this section. Furthermore, the reasons why EPC recipients and non-recipients adopted and did not adopt efficiency measures and the funding mechanisms used are described. This analysis stage is limited to descriptive statistics.

The last stage of analysis involved examining differences in the adoption and planned adoption of energy efficiency measures between EPC recipients and non-recipients. Pearson's chi-squared tests were conducted to test for association between having, and not having, an EPC and:

- Actual adoption of measures
- Number of measures adopted
- Type of measures adopted
- Amount invested in measures
- Planned adoption of measures
- Planned investment.

§ 5.5 Results

§ 5.5.1 Sample characteristics

No statistical significance was found for having an EPC and living in a certain dwelling category $\chi^2(5) = 9.5, p > .05$ (see Table 5.1). However, a statistical significance was noted in the dwelling age category with EPC recipients more likely to live in older dwellings $\chi^2(4) = 39.53, p < .001$.

In terms of household characteristics there was no statistical significance between having an EPC and household size, $\chi^2 (4) = 7.97$, $p > .05$ or plans to move, $\chi^2 (3) = 4.08$, $p > .05$ (Table 5.2). However, statistical significance was found for education, employment, age, income and duration of occupation (Table 5.2). In terms of education non-recipients were more likely to have a mid-level vocational training than non-recipients and less likely to have a university education, $\chi^2 (6) = 20.51$, $p < .01$.

DWELLING CHARACTERISTICS	EPC RECIPIENTS		EPC NON-RECIPIENTS		STANDARDISED RESIDUALS*	P
	#	%	#	%		
Type						
Apartment	19	7	117	13	<.05	.099
Detached	56	21	161	17	**	
2 under 1 roof	42	15	171	19	**	
Corner	52	19	158	17	**	
Terraced	94	35	288	31	**	
Other	8	3	25	3	**	
Age						
Pre 1945	66	24	301	33	**	.000
1945-1970	82	30	189	20.5	<.01	
1971-1990	101	37	247	27	<.05	
1991-2000	17	6	105	11	<.05	
2001-	5	2	77	8	<.05	
Don't know	0	0	1	<1		

TABLE 5.1 Dwelling characteristics (including missing cases)

+Missing cases=respondents who did not complete the survey; *Based on chi-squared tests; **No statistical difference+

In terms of employment EPC recipients were more likely to be retired, $\chi^2 (5) = 19.35$, $p < .01$ and to belong to the 66–79 age category, $\chi^2 (4) = 39.53$, $p < .05$. EPC recipients had a higher than expected count in the €1350–€1800 monthly income bracket resulting in statistical significance, $\chi^2 (5) = 13.68$, $p < .05$. Meanwhile, EPC recipients were more likely to have lived in their dwellings for more than 5 years¹² compared to non-recipients with 89% of recipients living in their dwellings for less than 5 years compared to 99% of non-recipients, $\chi^2 (2) = 61.88$, $p < .001$.

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This is affected by the fact that 10 EPC recipients have an EPC because their dwelling is 'for sale'. With these respondents removed a statistical significance difference remains and may reflect an error by respondents in terms of how long they have lived at their dwelling.

§ 5.6 Reported influence of EPC and context

§ 5.6.1 EPC possession and rating

The EPC sample consisted of 297 cases of which 10 had an EPC because they are selling their dwelling and 287 because they bought a house. 64.5% (185) stated that the EPC was made available to them when purchasing their dwelling but 35.5% (102) had to ask for the EPC. The main reason for asking for the EPC was an interest in the energy efficiency of the property (60%), followed by an understanding that it was a legal requirement (37%).

For those that had the EPC made available to them most saw it for the first time during the viewing (38.5%), followed by the notary's office (16%) and in the property advertisement (15%).

EPC ratings for the EPC sample group n = 287 are detailed in Fig. 5.1. Dutch policy typically targets dwellings with ratings lower than B, therefore, 83% of dwellings from this sample would be considered eligible for energy efficiency improvement.

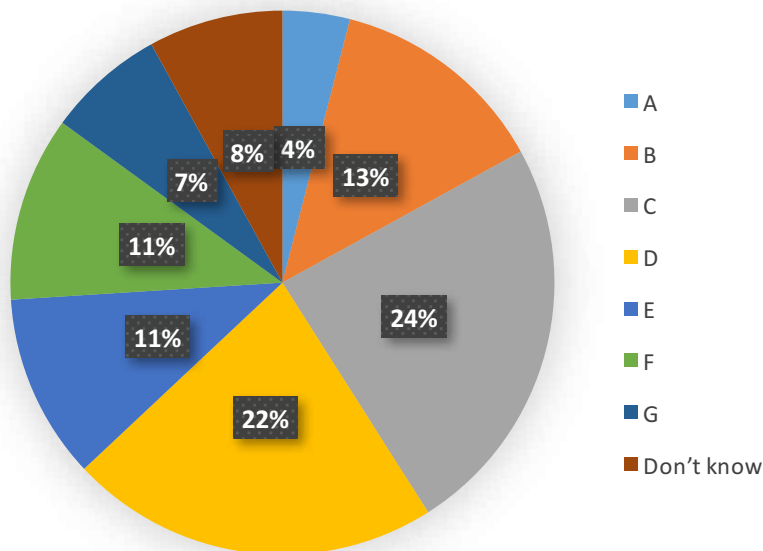


FIGURE 5.1 Energy ratings according to EPCs of the sample

§ 5.6.2 EPC influence at the point of sale

10% (29) (n=283) of the EPC sample group stated that the EPC influenced the property purchase. Of this 29, the EPC influenced decision to buy in 20 cases, influenced the sale price in 6 cases and influenced works carried out prior to occupation in 3 cases.

HOUSEHOLDS CHARACTERISTICS	RECIPIENTS		EPC NON-RECIPIENTS		STANDARDISED RESIDUALS *	P
	#	%	#	%		
Size						
1 person	52	19	137	15	**	.092
2	124	46	400	43.5	**	
3	37	14	160	17	**	
4	46	17	154	17	**	
4>	11	4	68	7.5	**	
Age						
20-39	118	40	385	37.5	**	.034
40-65	114	38	451	44	**	
66-79	26	9	49	5	<.05	
80>	2	<1	2	<1	**	
Not stated	37	12	140	12.5	**	
Education						
School	3	1	3	<1	**	.003
High School	8	3	32	3.5	**	
Lower vocational	4	1.5	7	<1	**	
Middle vocational	61	22.5	126	14	<.01	
Higher vocational	113	42	369	40	**	
University	80	29	368	40	<.05	
Other	2	1	9	1	**	
Employment						
Part-time	54	20	191	21	**	.002
Full-time	152	56	590	65	**	
Unemployed	10	4	21	2	**	
Retired	35	13	61	7	<.01	
Student	0	0	6	<1	**	
Other	7	7	38	4	**	

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HOUSEHOLDS CHARACTERISTICS	RECIPIENTS		EPC NON-RECIPIENTS		STANDARDISED RESIDUALS *	P
	#	%	#	%		
Monthly net income						
<1,000	2	1	1	<1	**	.019
1,000-1,350	6	2	17	2	**	
1,350-1,800	32	12	58	6	<.05	
1,800-3,150	91	34	312	34	**	
3,150>	87	32	347	38	**	
Not stated	50	19	175	19	**	
Duration of occupation						
<1 year	27	10	66	7	**	.000
1-5 years	213	79	835	92	**	
5>	29	11	11	1	<.001	
Plans to move						
Within 1 year	4	1.5	20	2	**	.251
1-5 years	33	12	77	8	**	
>5 years	37	14	136	15	**	
None	195	72	680	75	**	

+Missing cases are respondents who do not complete the entire survey; * Based on chi-square test; **No statistical difference.

TABLE 5.2 Household characteristics (including missing cases +)

§ 5.6.3 EPC influence post-purchase

22% (61) of respondents stated that the EPC influenced them in the adoption of energy efficiency measures post-purchase. Of these 61 cases: 87% stated that the EPC confirmed their ideas about some energy efficiency measures, 31% took more measures than planned as a result of the EPC and 20% took some measures that they previously had not thought of. Out of the 118 cases planning on taking measures 36% (43) planned on improving their EPC.

Results show a large percentage of recommendations were neither planned nor adopted (Table 5.3). Furthermore, a large percentage of measures were adopted and planned but not listed as recommendations. The most frequently adopted measure that was not recommended was boiler replacement while the most frequently planned measure that was not recommended was the installation of renewable technology.

§ 5.6.4 Non-recipients and EPC possession

14% (149) (n=1027) of the non-recipient sample that purchased a dwelling asked for an EPC but did not receive one. The main reasons for not receiving an EPC were that the estate agent stated the EPC was not required or it just was not made available even upon request.

This left a significant portion of respondents who did not request an EPC. The main reason for not requesting an EPC was that it simply was not considered necessary. A sizable percentage was put off by the fact that it was stated in the property advertisement that an EPC was not available. The third most common reason for not requesting an EPC was that the dwelling was considered adequately energy efficient.

MEASURE	RECOMMENDED	ADOPTED	PLANNED	% ADOPTED/PLAN COMPARED TO RECOMMENDED	NOT RECOMMENDED	
					ADOPTED	PLANNED
Boiler replacement	84	44	8	61	66	10
High performance glazing	122	43	13	46	47	17
Roof insulation	84	27	14	49	45	12
Floor insulation	99	32	14	46	35	21
Wall insulation	95	31	13	46	31	8
Heat recovery shower	1	1	0	-	4	3
Heat recovery m. ventilation	6	3	0	-	4	1
Insulation of piping	24	9	0	37.5	56	8
Draught proofing	42	17	6	55	64	19
Renewable technology	61	14	13	44	12	24

TABLE 5.3 Measures recommended, adopted and planned by EPC recipients

§ 5.6.5 Context: measures and funding

The two sample groups had similar motivations for adopting energy efficiency measures (Table 5.4). Energy bill reduction, comfort and 'end of life' of installations were the top three motivations among both EPC recipients and non-recipients for

carrying out measures. However, reasons for not adopting energy efficiency measures showed some differences. The main reason for not adopting energy efficiency measures among EPC recipients was lack of finances while for non-recipients it was consideration that their dwellings were adequately energy efficient.

Funding mechanisms are very similar between the two sample groups with savings being the most popular funding source for measures (Table 5.4). Mortgage arrangements were used by less than a quarter of respondents from both sample groups. Subsidies featured more strongly for the EPC recipients in being both a motivation for carrying out energy saving measures and a funding source.

	REASONS FOR ADOPTING MEASURES %											
	Reduce bills	Improve comfort	EoL of installations	Improve value	Subsidy	Poor EPC rating	EPC recommendations	Noise reduction	Experiment with technologies	Environmental	Advice-family/friends	Other
EPC Recipients n= 202	84	77	32	30	25	21	15	15	4.5	4	3	10
Non-recipients n= 657	81	81	37	25	10	n.a	n.a	18	2	5	3	9.5
	REASONS FOR NOT ADOPTING MEASURES %											
	Lack of finances	Dwelling is efficient	Uncertainty-occupation	Not enough time	Don't know how	Hassle factor	It is unimportant	Other				
EPC Recipients n=74	49	27	12	8	7	5	1	30				
Non-recipients n=322	32	50	11	10	11	15	2	17				
	FUNDING OF MEASURES %											
	Savings	Special Mortgage	Loans -family/friends	Normal loan	Special energy/loan	Subsidy	Other					
EPC Recipients n=201	78	20	3	6	2	21	9					
Non-recipients n=650	75	20	2.5	4	0.5	8	10					

TABLE 5.4 Reasons for adopting/not adopting measures and funding mechanisms (including missing cases+)

§ 5.6.6 Statistical analysis of influence of EPC

67% of the non-recipients carried out an energy efficiency measure since moving into their dwelling with the equivalent percentage for EPC recipients 73% (Table 5.5). However, there was no statistical significance with having an EPC and carrying out energy efficiency measures, $\chi^2 (1) = 3.7, p > .05$. Similarly, there was no significance with having an EPC and carrying out a greater quantity of energy efficiency measures $\chi^2 (8) = 3.25, p > .05$. Neither was having an EPC and investing more financially in energy efficiency measures found to be statistically significant, $\chi^2 (4) = 2.98, p > .05$.

A statistical significance was identified with possessing an EPC and future plans to adopt energy savings measures. EPC non-recipients were more likely to state that they don't plan on adopting measures compared to EPC recipients, $\chi^2 (2) = 8.34, p < .05$. A statistical significance was also identified for the amount the two samples plan to spend on future energy saving measures $\chi^2 (4) = 29.05, p < .001$. Non-recipients were more likely to plan on spending more than €4000 and recipients were more likely to plan on spending €1000–€2000.

Analysis showed that, with the exception of wall insulation and the installation of renewable technology, there were no differences in the types of measures adopted by the two samples (Table 5.6). EPC recipients adopted wall insulation significantly more than expected, $\chi^2 (1) = 12.02, p < .05$ and renewable technologies significantly more than expected $\chi^2 (1) = 7.69, p < .05$.

VARIABLE	EPC RECIPIENTS N=297		EPC NON - RECIPIENTS N= 1027		STANDARDISED RESIDUALS	P
	#	%	#	%		
Energy saving measures were adopted	202	73	663	67	**	.057
Number of energy saving measures adopted*						
One	48	24	162	25	**	.919
Two	52	26	164	25	**	
Three	35	18	121	18.5	**	
Four	30	15	93	14	**	
Five	16	8	56	9	**	
Six	8	4	29	4	**	
Seven	9	4.5	17	3	**	
Eight	1	<1	8	1	**	
Nine	0	0	1	<1	**	
Investment in energy saving measures						
>€4,000	81	40	264	41	**	.563
€2,000-€4,000	50	25	165	25	**	
€1,000-€2,000	34	17	113	17	**	
€500-€1,000	13	6.5	40	6	**	
<€500	23	12	68	10.5	**	
Energy saving measures are planned						
	n=274		n=960			
Yes	118	43	364	38	**	.015
No	50	18	257	27	<.05	
Don't know	106	39	339	35	**	
Estimated investment in planned measures						
>€4,000	24	20	110	30	<.05	.000
€2,000-€4,000	31	26	93	25.5	**	
€1,000-€2,000	30	25	84	23	<.001	
€500-€1,000	21	18	50	14	**	
<€500	12	10	27	7	**	

*Excluding 'other answers'; ** Not significant

TABLE 5.5 Association between EPC and adoption and investment in measures

MEASURE	EPC RECIPIENTS N= 276			EPC NON-RECIPIENTS N=988			P
	# ADOPTED	# NOT ADOPTED	% ADOPTED	# ADOPTED	NOT ADOPTED	% ADOPTED	
Boiler replacement	110	166	40	394	594	40	1.000
High performance glazing	90	186	33	308	680	31	.660
Roof insulation	72	204	26	230	758	23	.339
Floor insulation	67	209	24	192	796	19	.091
Wall insulation	62	214	22	137	851	14	.001
Heat recovery shower	5	271	2	7	981	<1	.150
Heat recovery m. ventilation	7	269	3	12	976	1	.156
Insulation of piping	65	211	24	212	776	21	.460
Draught proofing	81	195	29	307	681	31	.606
Renewable technology	26	250	9	49	939	5	.007
Other	23	-	-	84			

TABLE 5.6 Differences in the type of measures adopted

§ 5.7 Discussion

Results presented here confirm other research results that the EPC is a long way from policy aspirations expressed prior to its implementation. As with the research of Laine (2011), Watts et al. (2011), Amecke (2012) and Backhaus et al. (2011), a weak influence was identified for the EPC pre-purchase. A minority, 10% (29), stated that the EPC influenced their decision to buy their dwelling. Of this 10% (29), only 6 cases used the EPC to negotiate the price of the property.

Results also suggested weaknesses in implementation that have been highlighted elsewhere (see Tigchelaar et al., 2011). Of those who had an EPC, 64.5% had it made available to them, but a significant number, 35.5% asked for it to be provided. The majority of those who had the EPC made available to them viewed it at the stages intended for this instrument, either in the property advertisement or at the property viewing, 15% and 38.5% respectively. For 16% however it was made available at the notary stage when the opportunity to use the instrument in negotiations had passed.

Implementation issues surrounding the EPC are even more starkly apparent in the answers from the non-recipient sample. 14% asked for an EPC but did not receive one and 18% did not request an EPC because it stated in the property advertisement that it was unavailable.

Results also showed that the EPC still struggles for acceptance among some householders with 5% of the non-recipient sample reporting a negative impression about the EPC as the reason for not requesting one. However, this is less than reported by Tigchelaar et al. (2011) for their Dutch sample (over 30% of respondents reported a lack of trust in the EPC) and may reflect the improved EPC introduced in the Netherlands in 2010. Further details about how the EPC is valued were obtained from results showing that 3% didn't request an EPC because they planned to renovate their dwelling and 4.5% stated that they were aware that the dwelling, because of its age, was inefficient and therefore they did not consider an EPC useful. Interestingly, this 7.5% did not exploit the potential value of the EPC in offering them professional insight into the energy efficiency possibilities of their dwelling. This lack of value associated with the EPC is starkly emphasised by over half of non-recipients not requesting an EPC because they did not see it as necessary. A positive result about the value of the EPC among the EPC recipient sample was that 36% (43) of those planning on carrying out energy efficiency measures plan on improving their EPC.

In percentage terms the EPC had a greater influence on householders post-purchase with 22% (61) stating that the EPC influenced them to carry out energy efficiency measures. For the majority of these respondents the main influence of the EPC was to confirm their ideas about some measures while a smaller number stated that they carried out more measures because of the EPC or carried out some measures that they had previously not considered.

Analysing the differences between the EPC recipient sample and the non-recipient sample revealed a weak influence of the EPC. There was no statistical significance with possessing an EPC and carrying out energy efficiency measures. Statistical significance was found for the installation of wall insulation and renewable technology and possession of an EPC. Additionally, non-recipients were more likely to state that they were not planning on future energy efficiency measures compared to recipients. These results may stem from the fact that EPC recipients were more likely to live in older dwellings compared to non-recipients but it may relate to the EPC bringing awareness of less well known energy efficiency measures to the EPC recipient sample.

Previous research on the EPC highlights a paradox that is supported by research presented here. On the one hand Brounen and Kok (2010) and the Department of the Environment Water Heritage and the Arts (2008) suggest that dwellings with higher energy ratings have a higher market value. On the other hand, research by Backhaus et al. (2011) and Laine, 2011 found that few buyers use the EPC during negotiation. Similarly, research presented here found that few householders used the EPC during the transaction process. However, a third of EPC recipients who adopted energy efficiency measures reasoned that they did this to improve the value of their property. Among the non-recipient group, a quarter reasoned that they took energy efficiency measures to improve the value of their property. While potential buyers are unlikely to

negotiate on the basis of an EPC rating or energy efficiency a significant portion appear to appreciate that energy efficiency offers value to a property.

Results presented here support criticisms of the barrier model of conceptualising what drives householders to act, or not, on energy efficiency measures. This is clearly displayed when comparing the energy efficiency measures adopted or planned to those recommended which show that a very significant portion are ignored, close to 50% for most recommendations. Moreover, results show a large number of measures that are adopted or planned that were not recommended in the EPC. Overall, there is very little difference between the energy efficiency measures adopted by EPC recipients and non-recipients. All of these findings question the role of the EPC in identifying appropriate energy efficiency measures but also the motivations behind householder investment behaviour.

Furthermore, while householders frequently cited financial barriers, lack of action due to apathy remains the elephant in the room. 51% of the non-recipient sample did not request an EPC because they did not consider it necessary. Moreover, 27% of EPC recipients and 50% of non-recipients did not carry out energy efficiency measures because they consider their dwellings to be energy efficient. This is despite over 80% of EPC recipients living in dwellings rated below B and with over 50% of EPC recommendations for insulation being ignored. With 80% of the non-recipients living in dwellings constructed before 1990 it is assumed that significant energy saving potential remains within their dwellings.

A number of limitations characterise research results presented here. As with much research in this domain problems with representativeness were encountered. The recipient and non-recipient samples differed in a number of key areas which hampers direct comparability. Nevertheless, statistical analysis of the energy efficiency investment action of recent homeowners, those with an EPC and another without, is considered to offer insight into how the EPC functions and complements data on how the two groups reported their experiences with the EPC. Moreover, although the survey was distributed to a large number of addresses from the EPC database, respondents who received an EPC because they bought a dwelling remained a minority. This further highlights the need to create comprehensive formal monitoring and evaluation programmes for the instruments that define policy efforts for the existing housing stock. Such a monitoring and evaluation program could also offer valuable data on how the acceptance and effectiveness of instruments like the EPC change as the instrument matures.

§ 5.8 Recommendations

Based on the results of EPC recipients pre and post-purchase it is suggested that even if fully implemented the EPC as it is now will not have the impact intended. Research results presented here offer further empirical support to the argument that the EPC must be integrated within a framework of instruments that work together to improve energy performance of existing dwellings (Sunikka, 2006; Parnell and Popovic Larsen, 2005; BELAS, 2001; IMPACT, 2005). Similar to recommendations during ex-ante assessments it is suggested that the EPC and its recommendations act as a launch pad for more sophisticated mechanisms to drive energy performance improvement.

With the focus on the target group presented here, recent dwelling purchasers, one way to use the EPC as a launch pad for durable and objective energy based renovation is to link cost effective recommendations issued in the EPC to mortgage options. While respondents to this questionnaire had recently purchased their dwellings only 20%, from both sample groups, used their mortgage as a mechanism to fund energy efficiency measures. This is despite the fact that the first years of ownership appear prolific for the adoption of measures. Moreover, a sizable portion of the non-recipients stated their intention to carry out intensive renovation work yet no instrument comes in to play at this point to encourage deep energy based renovation. That over a third of EPC recipients claim that they will improve their energy rating when adopting measures in the future shows that the EPC can encourage a package approach to adopting energy saving measures rather than single measures. There are vast opportunities for more sophisticated approaches to mortgages that can maximise energy efficiency measures at the crucial but neglected trigger of dwelling purchase.

Results presented here support the argument that the barrier model is too simplistic as a means of developing instruments for existing dwellings. Both the number of recommendations that are ignored and the number of energy efficiency measures that are adopted or planned but not recommended in the EPC suggest much more nuanced investment behaviour than conceptualised through policy instruments. Added to this are the large number of respondents who consider their dwellings to be adequately energy efficient when it is known from EPC data that potential remains. Together these findings lead to a recommendation that much more clarity is required on what represents an energy efficient dwelling. On the basis of such clarity is a need for much stronger mix of instruments that determine the energy efficiency potential of a dwelling objectively and on the basis of climate change policy. This is opposed to the current situation which leaves determination of an adequate level of energy efficiency entirely to householders.

Further research into the policy instruments that can effectively trigger the energy saving potential of existing dwellings remains a priority. It is widely accepted that instrument combinations are required to deal with the many barriers and opportunities surrounding energy performance improvement of dwellings. However, theorising and practical examples of instruments that can work together to remove the information deficit, instil energy efficient dwellings with greater market value and trigger deep retrofit is much needed.

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