"A practice–theory approach to homeowners' energy retrofits in four European areas"

Bartiaux, Françoise ; Gram-Hanssen, Kirsten ; Fonseca, Paula ; Ozoliņa, Līga ; Christensen, Toke Haunstrup

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A practice–theory approach to homeowners’ energy retrofits in four European areas

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This article examines whether and how energy retrofitting of owner-occupied dwellings can be understood within the framework of social practice theories. Practice theories help to shift the focus towards more collective approaches and practices, rather than towards individuals. In addressing this question, energy retrofits are described and their variability compared in four European areas: Denmark, Latvia, the Coimbra area in Portugal and Wallonia in Belgium. Although these areas have different geographical, cultural and housing contexts, the Energy Performance of Buildings Directive (EPBD) provides a common form of regulation. As a policy, its main underlying intention is to promote the opportunities for energy retrofitting. Based on an analysis of 60 in-depth interviews with homeowners, it is found that energy retrofitting is not an integrative practice in 2010, despite the EPBD and other efforts to enforce such a practice. This lack of a retrofitting practice exists for a variety of reasons: it is not sustained by common and conventionalized routines, and by shared know-how and goals among relevant actors (e.g. homeowners and craftsmen). Based on practice theories, novel policy recommendations are provided to help to constitute an energy-related renovation practice in detached owner-occupied houses.

Keywords: Energy Performance Certificate (EPC), Energy Performance in Buildings Directive (EPBD), energy refurbishment, homeowners, policy measures, practices, retrofit, social practice theories

Introduction
The energy retrofit of the European building stock is of major importance to reach the targets of decreased CO₂ emissions. One of the most important policies in this regard is the Energy Performance of Buildings Directive (EPBD). It is a European Directive on the energy efficiency of buildings and mainly states that Member States must use Energy Performance Certificates (EPCs) on buildings. The efficiency and effect of the EPC as a tool in reducing CO₂ emissions from owner-occupied housing have been questioned from several sides. For example, house owners use the EPC to a low extent when deciding to buy a house or to renovate the house afterwards (Adjei, Hamilton, & Roys, 2011; Bartiaux, 2011; Gram-Hanssen, 2013; Watts, Jentsch, & James, 2011; see also Stieß & Dunkelberg, 2013).
This article uses a conceptual framework drawn from social practice theories. Several researchers have previously argued that these theories are a promising approach for raising new policy and research questions within the sustainability agenda (Gram-Hanssen, 2011; Shove, 2010; Shove, Pantzar, & Watson, 2012). Indeed, rather than focusing on how individuals relate to single policy instruments (e.g. the EPC), practice theories help to shift the focus towards more collective approaches on how groups or populations relate to more or less sustainable practices.

The three research questions raised here are as follows:

- Can energy-related renovation (hereafter called retrofit) be conceptualized as a practice among house owners in the way that practices are defined by social practice theories (as explained below)?
- If it can, to what extent can it be viewed as a common practice across European member states?
- Do the EPBD and the EPC contribute to structuring this practice?

To address these questions, social practice theories are used to analyze in-depth interviews conducted with homeowners on their retrofits. These retrofits are described and compared and their variability is shown in four European areas.

Energy retrofits take various forms; they can include installing an efficient boiler, insulating the attic, or replacing frames and windows with energy-efficient ones. This work can be done as do-it-yourself (DIY) projects or by specialist tradesmen, or as a combination of the two. These energy retrofits are the unit of analysis in this article.

The article is structured as follows. A literature review is provided on practice theories and their application in research on home renovation. The evidence from 60 in-depth interviews is then analyzed. The discussion considers whether energy retrofits can be viewed as either a sole practice or a set of practices and answers the research questions. It also reflects on how the results might be used for developing the EPBD and other energy policy instruments aimed at encouraging energy-related renovations of existing owner-occupied houses. The conclusion summarizes the main insights of the analysis.

**Theoretical framework**

Recent years have seen several attempts to use theories of social practices as a basis for understanding everyday practices related to energy consumption (e.g. Bartiaux & Réategui Salmón, 2012; Gram-Hanssen, 2010b; Hargreaves, 2011; Ropke & Christensen, 2012; Strengers, 2010, 2011). These studies use the line of practice theories as formulated by Schatzki (1996), further elaborated by Reckwitz (2002a), and later related to consumption studies by Warde (2005) and Shove and Pantzar (2005). This approach to practice theories accentuates the collective aspect of practices, following from Giddens’ theory of structuration (Giddens, 1984), and Bourdieu’s outline of a theory of practice (Bourdieu, 1972, 1980). Schatzki understands practice as a coordinated entity, i.e. as ‘temporally unfolding and spatially dispersed nexus of doings and sayings’ (Schatzki, 1996, p. 89).

Several authors have used approaches within practice theories to study home extensions and home renovation. Hand, Shove, and Southerton (2007) and Shove, Watson, Hand, and Ingram (2007, pp. 21–34) focus on how a growing amount of things and technologies puts pressure on the spatial layout of homes and thus pushes homeowners towards expanding their homes. Hand et al.’s (2007) study focuses on practices in kitchens and bathrooms. They do not use practice theories to understand the practice of expanding or renovating the home. Instead, these are deployed to understand the practices taking place in the home that are related to the renovations. A similar use of practice theories is made by Maller, Horne, and Dalton (2012), who argue that policy to encourage people to carry out ‘green renovations’ would work better if it included understandings of the practices and aspirations of the homeowners. Their study explicitly focuses on green renovators and thus comments on the paradox that most of these green renovators increase floor size by adding bathrooms or expanding the kitchen or the living room.

**The practice of renovating a home**

In their study on green renovations of owner-occupied heritage housing, Judson, Iyer-Raniga, and Horne (2014) also show the tendency for expanding the number of rooms. However, their study not only relates practice theories to the everyday practices that take place in the homes but also uses these theories in the understanding of the practice of renovating a house:

> the practice of renovation is governed by a system of permits, together with the physical condition of the existing building, and the available technology and infrastructure, as well as the capabilities of home renovators, professionals and contractors. (p. 65)
In their analysis they include different shared meanings related to renovations which are respectively environment, heritage and ‘comfort, cleanliness and convenience’, and they describe how these last meanings are most often the dominating ones when renovating owner-occupied heritage housing.

A study on DIY practices in home renovation focuses on the distribution of competences between humans and non-humans, where new products help to shape new ways of doing home renovation, and thus allow non-skilled DIY practitioners to perform more work on their house (Shove et al., 2007, pp. 41–69; Watson & Shove, 2008). This research thus focuses on DIY and analyzes it as a practice.

Karvonen (2013) uses practice theories to study the retrofitting of owner-occupied housing. He argues that existing approaches for encouraging house owners to retrofit do not work sufficiently and that a community-based approach would work better. Karvonen underlines that some uses of practice theories have a problem as they focus on the micro-level and the habitual rather than including a longer time span when understanding retrofits. Karvonen uses insights from practice theories to argue that community approaches, where people engage and learn from each other and form a network between actors, are a more promising approach to encourage homeowners to retrofit.

The current study implicitly follows insights that retrofitting a home is closely related to the practices that are taking place in everyday life in the home (Hand et al., 2007; Maller et al., 2012; Shove et al., 2007), though the main focus in this article is on understanding the domestic retrofits by the use of practice theories, as also done by Karvonen (2013) and Judson et al. (2014). It is assumed that renovating a home in general can be considered as a practice, but the question to be answered here is whether retrofits can be conceptualized as a practice in themselves and, if so, to what extent it is a common practice throughout Europe and what role the EPBD has, or might have, in constituting such a practice.

Four components
Within the line of practice theories that is drawn on in this article there is a discussion on the number and nature of the components that take part in linking ‘sayings and doings’ in order to constitute a practice. Schatzki (1996) originally proposed three ‘forms of linkage among practice-composing behaviors’ (p. 91) – understandings, rules and teleo-affective structures – which Warde (2003) refers to as understandings, procedures and engagements. Shove and Pantzar (2005) simplified this by combining understandings and rules into the component ‘Competences’, renamed teleo-affective structures as ‘Meanings’ and added ‘Products’, with inspiration from Reckwitz’s (2002b) work on how to include the material.

Following Gram-Hanssen (2010a, 2010b, 2011), four linking components are considered here as the most relevant in discussing and analyzing energy-related retrofits. The main difference between the approach first formulated by Shove and Pantzar (2005) and later used in numerous other studies, and the one by Gram-Hanssen (2011), is that Gram-Hanssen’s approach follows Schatzki and, thus, the competence component of the Shove/Pantzar model is made of two components, which are named here: (1) know-how and habits; and (2) institutionalized knowledge and explicit rules. Gram-Hanssen’s approach is preferred here due to the desire to understand the role that the EPBD (an explicit rule) might have in forming or establishing a practice of retrofitting. Furthermore, it makes it clearer that this practice of retrofitting, if any, would be structured by both explicit regulations and established technical knowledge – in which the EPBD is taking part – as well as by unconscious routines of homeowners and craftsmen imagining and carrying out the actual renovation works.

The following gives a short introduction to the four components which are considered here as those holding together the ‘practice’ (if any) of retrofitting a house in an energy-saving way. Technologies and products are key aspects in the practice of retrofitting and are related to the physical features of the house, its materials and the available products on the market for doing the renovations, as shown by Watson and Shove (2008). Know-how and habits include the skills and know-how that craftsmen and DIY homeowners have or acquire on how to carry out work on a house. Institutionalized knowledge and explicit rules can be directly decided and influenced through policies such as the regulations from the EPBD and refer, for example, to procedures to apply for energy-related subsidies, explicit rules on house insulation, and written advice given in energy assessments and EPCs. Engagements, as renamed by Warde (2005), respond to what Schatzki (1996, p. 89) calls teleo-affective structures and are made of ‘ends, projects, tasks, purposes, beliefs, emotions and moods’. Engagements include but are certainly not reduced to the reasons that homeowners have for retrofitting their house.

Questions in operationalizing practice theories
In operationalizing practice theories to analyze homeowners’ energy-related renovations, a number of questions rise. A first question is how to account for the social variations within a practice, if any, either between or within countries, in retrofitting houses, e.g. by young families or by elderly people. For Warde (2005, p. 139) the three key components of the nexus identified by Schatzki may vary.
independently from one another between groups of participants. It is thus relevant to describe these variations, since a practice is not ‘drowned’ in its variations.

The next question is the routine aspect versus the long time span in retrofits, as also raised by Karvonen (2013). For Reckwitz (2002a, pp. 249–250):

a practice represents a pattern which can be filled out by a multitude of single and often unique actions reproducing the practice. [...] The single individual – as a bodily and mental agent – then acts as the ‘carrier’ (Träger) of a practice.

A practice is a pattern that needs regular enactment at the aggregate level, not necessarily by each single individual: thus an infrequent doing (for the individual), such as changing the windows, can be seen as part of the home renovation practice, even if each homeowner does this only once in his life.

A further topic requiring consideration is how a retrofit as a possible practice assembles different doings (e.g. roof insulation, installation of energy-efficient boilers, own production of electricity with photovoltaic panels, installation of triple-glazed windows, external wall insulation, etc.). Are these doings put together in a set of practices or are they integrated and coordinated? For Schatzki (1996, p. 98), integrative practices are ‘the more complex practices found in and constitutive of particular domains of social life’. He defines an integrative practice as ‘a set of doings and sayings linked by understandings, explicit rules, and teleoaffective structure’ (p. 103), but for him these components of practice organization must not be the same ones that govern all the behaviours involved: some behaviours are ‘linked with the same components of practice organization, others via interrelations and cross-references among these components’ (p. 103). Examples include farming practices, cooking practices and business practices. They are called ‘complexes of practices’ by Shove et al. (2012).

Shove et al. (2012, p. 81) introduce the concept of bundles of practices that ‘are loose-knit patterns based on the co-location and co-existence of practices’. They hypothesize that bundles and complexes appear and disappear as a consequence of collaboration and/or competition between practices (p. 88). Practices collaboration may be achieved by the coordinative role of components, such as engagements, in linking otherwise disparate practices, or by ‘epistemic objects’, which are defined by Knorr Cetina (2001, pp. 181–183) as ‘any scientific objects of investigation that are [...] meaning-producing and practice-generating; they provide for the concatenation and constructive extension of practice’.

Case areas and methods

In order to study the retrofits of owner-occupied houses and their links to the common EPBD regulation, four geographical areas were chosen to represent the high variation in climate conditions and building regulations, including the implementation of the EPBD.

EPBD implementation in the four areas

The implementation of the EPBD at the time of the interviews varied between the four case areas. In Denmark the EPC dates back to the 1980s; since 2006 it has followed the EPBD. At the time of the last interviews (2009–10) the EPC in Denmark was already mandatory for all houses sold as well as for new buildings and it also included recommendations for energy improvements. In Wallonia the EPBD was not fully implemented by the time of the interviews, but since 2007 homeowners could buy an energy assessment of their house and get energy labels for it. In Latvia, at the time of the interviews, the EPBD was implemented but only with the minimum requirements of the directive, meaning that the law did not apply to existing single-family houses because the EPC was needed only for buildings of more than 1000 m² (the law was changed in 2013). In Portugal, the EPC scheme comprised the full implementation of the EPBD by January 2009: thus at the time of the interviews this was still rather new.

In-depth interviews

In-depth interviews are close to ethnographic interviews (Spradley, 1979) with persons considered by the researcher to be so knowledgeable about their experience that they are called ‘informants’ in lieu of ‘respondents’. A total of 60 in-depth interviews were realized in the four case areas (and 25 more with apartment owners in Portugal and Latvia that are not analyzed here). Nearly all interviews were conducted at the home of the informants, some with both spouses if they were both interested and available. Thus, the total number of respondents is 80 as 20 interviews were realized with both spouses (for details, see Table 1).

Most interviews were done in 2009–10 as part of the European Union project IDEAL-EPBD and 10 Danish interviews were done in 2005 during the SEREC project, with the same interview guide in both projects. The intention was to talk to people who had recently bought a house and who had an EPC or an energy assessment done on their house. But as described above, in three of the case areas the EPBD was not fully in place, meaning that few or no households had an EPC. The samples in the four case areas thus varied according to actual possibilities. In
all cases, interviews were done with people who had either bought a home or received an energy assessment, both within the few last years.

The interview guide included questions about the home renovations (whether related to energy savings or not), the justifications thereof, the planning and the types of help and advice received, if any. By prompting the informants with the topic of ‘renovation’ or ‘building work’, the interviewers received much less information on the adjacent practices of home decorating and shopping for home commodities. Environmental knowledge and concern were dealt with at the end of the interview to avoid the possibility of this influencing the explanations on renovations carried out. The interview guide is presented elsewhere (Gosselain & Bartiaux, 2011, pp. B.25ff.). The in-depth interviews lasted between 45 minutes and two hours and all were recorded and transcribed. To analyze the interviews, content analysis was mainly used.

Qualitative interviews with householders are used here as the basis of analyzing collective practices. Even if individuals are interviewed, their expressions and understandings should not be interpreted as idiosyncratic understandings, wishes or reasons of independent individuals. They should and will be rather interpreted as manifestations of collective structures that are holding together and organizing the practices of their carriers. When interviewing a limited number of interviewees, as is always the case in qualitative research projects, caution must be taken on how results are generalized. The interviewed households behind this article cannot be claimed to represent all the renovation projects that occur in the four case areas, but they do provide in-depth knowledge on some of the variations of the ways of retrofitting a home.

### Energy retrofits

#### Home renovation in general

The interview material from the four case areas includes many examples of renovation projects, ranging from simple refurbishments such as painting walls to comprehensive and ambitious projects, including total renovations of kitchens and bathrooms, demolition of inner walls and building an extension to the existing house. There are also many homeowners who have performed renovations that can be related to energy savings, typically replacing windows and insulating the roof, or replacing boilers, though in many of these cases energy saving was not the main or only framing of these renovations. Some renovation was carried out in all interviewed households even if there are also huge variations in what was done.

In Wallonia, Latvia and Denmark, there were some major renovations of cheap and older houses that thus offered the opportunities of being renovated and rebuilt according to the owners’ own ideas. Especially in the Portuguese sample, but also recognizable in the other areas, there were examples of the opposite: only light retrofits were undertaken when the house was regarded as a short-term and not a life-long abode (i.e. the residents were uncertain about their length of tenure). The focus below will be on analyzing

### Table 1  Sample characteristics in the four case areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Interviewed households</th>
<th>Energy label?</th>
<th>Sample of informants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>15 households (11 interviews with both spouses). There were 10 interviews in 2005 and five in 2009–10</td>
<td>All houses have a label below B, indicating that the house could be renovated to achieve a higher energy efficiency</td>
<td>Drawn from a list of houses sold recently with energy labels. Wide socio-economic variation in the sample</td>
</tr>
<tr>
<td>Wallonia</td>
<td>23 households (six interviews with both spouses)</td>
<td>11 have acquired energy labels, 12 recently bought their house without an energy label</td>
<td>Either drawn from a list of energy assessments or contacted through varied networks. Wide socio-economic variation in the sample</td>
</tr>
<tr>
<td>Portugal</td>
<td>16 households (two interviews with both spouses)</td>
<td>3 houses had an Energy Performance Certificate (EPC), the rest did not</td>
<td>Contact through the university network. Sample represents well-educated homeowners in the Coimbra area</td>
</tr>
<tr>
<td>Latvia</td>
<td>6 households (one interview with both spouses)</td>
<td>No house had an EPC</td>
<td>Either drawn from lists of energy assessments or contacted through networks. Wide socio-economic variation in the sample</td>
</tr>
</tbody>
</table>

Note: Eighteen supplementary in-depth interviews were realized with apartments’ owners in Latvia, and seven in Portugal, to reflect the building stock’s distribution into houses and apartments in these two countries (Central Statistical Bureau of Latvia, 2009; Instituto da Habitação e da Reabilitação Urbana, 2007). This material is not reported on in this article.
these renovations practices and their variations by using the analytical framework of practice theory formulated by Gram-Hanssen (2011). The analysis will thus be divided into the four components producing and reproducing a practice – and within each one similarities and differences between the geographical areas:

- know-how and habits
- institutionalized knowledge and explicit rules, in particular the role of the EPC
- engagements
- technologies

**Know-how and habits**

Know-how and habits are an important component of what constitutes a practice. They represent the routines taken for granted, the things people do without reflecting that they are doing it, and therefore are key when discussing whether a practice may be conceptualized as such, or not. They also represent the routinized part of a practice, which Karvonen (2013) rightfully questioned because renovating a house often includes doings (e.g. insulating the roof) that the single house-owner only does once in his life. Thus the knowledge networks are very important in creating and/or sustaining know-how and the informants often seek others’ advice before and during the renovation process. These knowledge networks include family members, friends and colleagues, among whom there are professionals and craftsmen, and also new acquaintances met on Internet fora. Even if renovating is not done on a daily basis or by routine, it thus makes sense to include know-how and knowledge networks in the understanding of what assembles a practice, if any, of retrofits. This know-how is very often distributed through informal conversations between people, but several DIY informants also consulted craftsmen for advice on particular tasks. Others had professionals or craftsmen in their personal network of friends and relatives.

For instance an energy-related renovation was performed differently in one Danish family, after the husband’s father advised replacing the windows instead of repairing them – advice they followed. Another energy-related example came from a Danish family wanting to change their entrance (front) door for one that has less transparent glass. The carpenter told them that they should choose energy glass for their new door, instead of the non-transparent ordinary double-glazing they were considering, and so did they. Some informants also consulted the local DIY centre for information and advice. These examples thus show a collective know-how among the Danish homeowners’ networks. In general the Danish informants expressed trust in craftsmen’s work and advice, however this was not the case in all the other case areas.

In Portugal all informants, except one, had a contractor whom they already knew, or who was recommended by friends. The Portuguese informants in general rely on the advice of building professionals and trust them, whereas DIY is not common. These best-educated Portuguese informants also search for detailed and practical information on the Internet and rely on friends with construction knowledge who influence them. Echoing the Danish case, when contractors were involved with renovations, they also gave important advice:

It was the builder who suggested we install insulation in the attic because it was better for comfort, it was better in winter to avoid cold entering the house.

(Coimbra area, male electrical engineer, 43)

In Latvia, similarly, knowledge on what renovation work to do, how to do it and with which craftsmen mostly comes from friends, colleagues, the Internet and from advertisements:

Opening Google, typing ‘boilers’ and then looking through, but there is no full information. This time I called my brother, asking whether maybe he knows something about it.

(Latvia, male electrician, 35)

A Walloon informant became a DIY practitioner after a problematic situation with a carpenter (‘the clown I called to do the work should have advised me, as a specialist, to do it [insulate the gable from the outside]’), and he expressed his opinion on the lack of know-how among craftsmen:

No craftsman, no craftsman is interested in the problem of insulation. For them, it is... it is a chore. And in general, anything related to energy has no interest for craftsmen. [...] Furthermore, in general, they rather don’t care about regulations.

(Wallonia, male engineer, 35)

And this opinion regarding craftsmen appears to be rather widespread in Wallonia according to the interviewees, even if some mentioned craftsmen dedicated to energy savings, such as one specialized in cellulose insulation, or a DIY retailer selling environmentally friendlier products. Perhaps as a response to the perception of insufficient know-how among craftsmen, in Wallonia there are participatory renovation projects – where people gather, learn techniques and collaborate to the same realization – and Internet websites on alternative construction techniques, as reported on by one informant.
In all four case areas, friends, family and the Internet are the main sources of advice on how to renovate a home and for finding trustworthy contractors. In Denmark and Portugal, craftsmen and contractors are generally seen as reliable sources of information, whereas in Belgium and Latvia their advice is more questioned. However, in the four case areas, know-how is generally distributed between several types of craftsmen (frame and window installers, carpenters, heating installers, etc.). With the exception of Portugal, DIY is widespread in all countries/regions. Many DIY practitioners actually have some knowledge and skills in the practice of renovating a house, and to some extent this also includes knowledge on energy retrofits.

However there are variations both between the countries/regions and within each country/region. In Wallonia, for instance, one informant remarked that elderly people do not have ‘the culture of energy’. However, it can be asked whether this ‘culture’ has yet turned into know-how and practical knowledge on insulation and energy-efficient boilers, as exemplified by the same young man: he finds that his boiler ‘is not an old boiler […] it’s a boiler from the seventies’. An exception to this weak know-how is, when buying an old house, the ‘mental routine’ (as Reckwitz, 2002a, says) of knowing that frames and windows are likely to need replacement: during her first visit to her future house, ‘just by seeing the old frames with single-glass windows, I knew that they had to be changed’, says a single Walloon mother. Similarly in the other areas there are variations in know-how among the informants. There may be a tendency for the younger people to have more know-how than the older ones, and furthermore a tendency for the Danish and Walloon informants to have more knowledge than those in Latvia. At least one Portuguese informant was involved in the development of the Portuguese EPC, a form of institutionalized knowledge to which the next section is devoted. The preparation and the implementation of the EPBD has generated a common knowledge among engineers involved in research programmes to prepare the EPCs, but this knowledge is not well diffused, among either the professionals or the homeowners.

Institutionalized knowledge and explicit rules
This section discusses two different aspects: first, the influence of the EPC; and second, the influence of other programmes or sources of information from authorities.

The first question is: To what extent is the advice in the EPC used by recent house owners? Most Danish informants remembered the EPC or some kind of information they got when purchasing the house. Some were more positive than others about that report, depending on the trust in the quality of the label and its recommendations. For instance, one interviewed (wrongly) remembered the energy label report as carried out by the estate agent and was therefore very critical about its validity:

Well, I believe that a lot of it is just a bit fancy, like playing to the gallery. I don’t give it much credence when they themselves [the estate agents] [prepare the energy labels] […].

(Denmark, male, draughtsman, 35)

The EPC is not always a source of new knowledge:

Well, the things that are stated were that the old windows could be replaced. Yeah, we could see that ourselves.

(Denmark, male graduate in his 40s)

Furthermore, some Danish informants commented on the ‘million documents’ they received when purchasing the house and felt that the EPC was ‘drowned’ within all the documents.

Three Portuguese informants had an EPC. Although they recognized its usefulness, they did not remember all the measures and none considered the EPC when planning their renovations. The reason is not because they did not trust the EPC, but due to its timing: they had already planned the renovations, either energy-related or not. They ordered the certificate just because it is mandatory and paid for it only to avoid paying penalties rather than to benefit from potential savings.

For the 11 informants from Wallonia who paid for an energy assessment of their house, the EPC was not often a major influence on their renovations but it could be useful in raising awareness of unknown insulation possibilities (e.g. external walls). And among all the other informants, no one wished to have an EPC because they claimed to know enough already or preferred not to know more:

No, because with the house, as it is, I don’t see really what I can change […] I cannot imagine sacrificing the stones to find myself with a wooden façade.

(Wallonia, female psychologist, 46)

Although the EPBD was implemented at a different pace in the four case areas, the EPC does not seem to influence any of the renovations for those of the informants who have an EPC on their private house (all in Denmark, about half in Belgium and three in Portugal). Even if the EPC may be seen as a potential epistemic object (Knorr Cetina, 2001) that could reorganize and recompose diverse practices and resources, it does not appear to play this role now in the four areas under investigation.
When it comes to other institutionalized knowledge or programmes from authorities, these seem to be more influential in Wallonia than in the other case areas. Television broadcasts are communicating institutionalized rules about regional subsidies and fiscal (federal) rebates for energy-saving works or investments. Indeed, the search for information rapidly led all the informants interested in energy and/or money saving either to the Walloon Internet website on energy matters or to one energy office (also managed and paid for by regional authorities) giving free advice. Nearly all informants referred to these instances of mass media (‘Of course I knew that there are subsidies from the Walloon Region or something […]’). Many Walloon informants received at least one subsidy and a fiscal rebate: most often for energy-efficient frames and windows, less often for boilers and/or roof insulation, and more rarely for photovoltaic (PV) panels and outside wall insulation. At least eight Walloon informants benefited either from a low-interest loan for low-income families or from a special subsidy, both granted if also doing energy-saving renovations. In Wallonia several other sources of knowledge have been institutionalized for a longer time, through alternative media and networks ranging from a specific magazine to product information in shops for organic food (most of them have a DIY department, with environmentally friendlier products).

In the other case areas economic incentives do not seem to be that important. At the time of the interviews, the Danish government had just launched a new financial support for renovations. Only one of the interviewed Danes, however, had applied for the replacement of their old oil boiler with a natural gas boiler. However, they thought that it was a ‘lucky coincidence’ between this programme and the time they were replacing their boiler. Other types of institutionalized knowledge were, however, used by Danish informants, such as Internet-based calculators and websites with information from authorities. In general the Danish house-owners expressed that they are quite well informed about energy issues, although this does not necessarily mean that this information is implemented during the renovation process.

In Latvia there seems to be more variation between how people related to this kind of institutionalized knowledge. Younger informants more often mentioned institutionalized or theoretical knowledge on renovation work. They appeared to be more open to this type of new knowledge and more willing to contribute towards implementing energy-efficiency measures in their buildings:

In general the main fact was that the theory from the book convinced us. But it was important that we read it ourselves.

In summary, at the time of this survey (2009–10), in Denmark and Wallonia, more than in Portugal and Latvia, the authorities seemed to be part of establishing a knowledge infrastructure about energy-related renovation. In these way authorities can structure institutionalized knowledge, which over time can also influence know-how, which has happened to a smaller extent as described in the previous section. Even where EPCs are institutionalized, they are not related to other explicit rules (e.g. fiscal rules), which lowers their potential impact.

**Engagements**

In all countries/regions, the main and common engagement associated with renovating is to have a nice home, including a comfortable indoor temperature and aesthetic interior, the latter being often more important than energy-related renovations:

> It was old-fashioned, and the rooms […] it was more in terms of decoration, hum, the thermal part didn’t function that well. Especially in the attic.

(Coimbra area, female teacher, 40)

Another engagement is related to convenience and functionality, which often drove people to redesigning house interiors, namely in old houses where rooms were often found too small:

> All the indoor space and the resizing of the divisions had to be carried out.

(Coimbra area, male PhD biologist, 44)

The interviews ended with questions on energy and environment and though it is possible in all case areas to find informants who acknowledge the importance of the environmental issue and, in some cases, also explained that they try to save energy in their daily life, the environmental issue was not a main factor sustaining energy-related renovations, except in Wallonia as shown below. Several contradictions indeed indicate a lack of conviction when faced with questions about global warming and/or personal practices. The following contradiction (from a Walloon insurance broker who admitted earlier in the interview that most of his renovations were to save money or to satisfy his ‘desire’ and not for environmental reasons) also illustrates how he links sayings and (not) doings in a socially acceptable way, almost as a victim:

**Interviewer:** For you, is there a link between energy consumption and environmental issues? Do you relate them?
Informant: No. I don’t, I have never been made particularly aware of that and ... no.
Interviewer: Do you hear about it?
Informant: Well, one hears about it, one looks at news on TV and so on. (Wallonia, male insurance broker, 62)

But at least for four DIY Walloon homeowners, energy-saving works are meant to protect the climate, as a part of an environmentally friendlier ‘way of life’ that is not driven by financial reasons.

In general, saving energy is never an end in itself related to renovations because if it is mentioned it has several meanings (the main ones being ‘to save money’ or to be ‘greener’):

Well, everything that contributes to reducing our energy bills and at the same time improving the environment – we are really keen on. (Coimbra area, female engineer, professor, 35)

In Latvia, since the economic crisis of the beginning of 2009 and the yearly increase of energy prices since then, reducing the energy costs of the house can be considered in many cases as the main meaning associated with energy-related renovations. However, this also depends on the level of renovation knowledge and on practical experience.

So the framings to save energy are varied and always in combination (as already noted by Bartiaux et al., 2006, p. 222). For example, an obvious reason to change windows and frames is their bad condition, the sensation of coldness and/or dampness and also the desire for (more) comfort. Other goals are acoustic insulation and the wish to have more light by enlarging the windows. For roof insulation, however, these associated benefits have to be primary (and not secondary), and the factor most often invoked is the need for more living space, with the attic transformed into one or several bedroom(s). For some of the oldest houses in Wallonia and Portugal a main end for making energy improvements in the home was actually to obtain a warmer temperature inside.

Finally one further meaning associated with renovating a house is that it is an enjoyable hobby – DIY activities are widespread and appreciated, especially in Denmark:

We wanted a house that was cheap. The only thing we cared about was that it had brick walls. Because the rest has been torn down and changed. (Denmark, male craftsman in his 30s)

In summary, the engagement structure of homeowners is multidimensional and includes many different ends in each of the four countries/regions examined.

Reducing these meanings of decreasing residential energy consumption to financial savings and climate protection is certainly not a valid account of our observations.

Technologies

Technologies include here the physical layout and construction of the houses as well as the products used in the renovation process. Changing frames and windows is the most common energy-related renovation in the four countries regions, though there are differences in what is regarded as high and normal energy standards. In Denmark, for example, the low-energy product would be triple- or double-glazed windows with an energy-saving coating, whereas double-glazed windows without coating would be the standard solution in the other geographical areas. For example, in Wallonia a craftsman advised a house owner against triple-glazing windows with words like ‘exaggerated’ and ‘not worthwhile for this house’, and this informant followed the advice and ordered double-glazing.

Another example of how the materiality of the house influences energy-related renovations relates to construction aspects, as exemplified by the renovation project of a Danish informant. She tells that the project was to insulate part of the roof with 300–400 mm rock wool and to leave unchanged another part of the roof that already had 100 mm:

Interviewer: And you don’t consider changing this as well?
Informant: Well I have thought about it, but I do think it is a big job, because for this part of the house you need to do it from above, […] remove everything […] and then adjust the fascia board […] a very large operation, so we do not really consider that. (Denmark, female architect in her 40s)

This also links to how energy-related renovations change the look of the house, or not. In some cases they can be done without any visible changes to the outside of the home, whereas in other cases the construction type does not allow this. In both Wallonia and Portugal there were examples of retrofit projects that could not be carried out because of the heritage values of the building and laws, e.g. for protecting historical centres:

I would like to install thermal insulation, but the existing walls prevented us from installing it because of the stone work in the windows. (Coimbra, male engineer with a PhD, 41)

Regarding the products, several Walloon informants reported contradictory advice on insulation material...
and techniques. This lack of consistency may delay or hinder energy-saving renovations.

For the insulation material, there are many opinions on the matter. Many opinions [...] here I have more conflicting opinions than for the frames.

(Wallonia, male civil servant, 29)

These last examples show that components that sustain a practice (if it may be conceptualized as a practice) are interrelated. In historical city centres, the building characteristics interact with institutionalized rules. The last example repeated what was already noted about the know-how: homeowners, craftsmen and professionals do not share a common and particular goal (that would be ‘to save energy where ever possible in a building’).

In summary, building configurations, technologies and products are varied and do influence energy-related renovations, sometimes by limiting them.

Discussion

This discussion begins by answering the three research questions of this article. The first is whether energy-related renovations can be interpreted as a practice. This analysis shows that energy-related renovation is not a practice in 2010 in the four European countries/regions studied, despite the EPBD and the efforts of the energy advisors to create such a practice. Indeed, the four components creating and sustaining a practice have not been described as having little or contradictory effect on energy-related renovations. The EPCs play a minor role in creating such a practice in the four countries/regions studied. Even if institutionalized rules exist to calculate and deliver these EPCs, even if these certificates may be seen as epistemic objects that concatenate otherwise disparate practices (like installing triple-glazed windows and insulating attics), a conclusion of this research is that a social practice cannot be created by a law or a European Directive before being sustained by common and conventionalized routines, both mental and behavioural, and shared know-how and ends. Such a practice would indeed integrate know-how that are now fragmented and differentiated between several types of craftsmen (carpenters, heating installers, frames and windows installers, etc.). These craftsmen either do not share a common goal or do not recognize themselves as ‘energy-saving practitioners’. But at least four DIY Walloon homeowners would probably accept being called so because they are engaged in such works with this meaning. Thus, in general, the craftsmen or the supply side make it very difficult to undertake an integrated energy retrofit, not only because of this weak engagement and a fragmented and often insufficient know-how, but also because of the resulting contradictory advice.

Furthermore, this study has shown – as already found for Denmark and Belgium by Gram-Hanssen, Bartiaux, Jensen, and Cantaert (2007) and for Latvia and Bulgaria by Bartiaux et al. (2011) – that the engagements for decreasing residential energy consumption, if any, cannot be reduced to financial savings and climate protection, but these goals nevertheless are the only ones in the EPCs and most energy-policy instruments.

So instead of one practice of retrofits, this research shows that energy-related renovations rather form ‘bundles’ (as conceptualized by Shove et al., 2012) of still separate practices such as installing efficient boilers or insulating roofs or changing windows to triple-glazed ones, or coating the exterior walls with insulation, all these practices being generally performed by different types of specialists. The techniques, products and know-how are also differentiated.

The second research question is whether retrofits form the same bundle of practices in the four studied areas, and the answer here is also negative. Indeed, in Denmark and to a lesser extent in Latvia and Wallonia, DIY is a major part. In Wallonia, differentiated energy-saving practices are subsumed by similar subsidies or even integrative ones. In Portugal and in Denmark, specialist advice from craftsmen is trusted more than in Wallonia. In Denmark, standards of products and technologies are higher than in the other three countries/regions considered. In all the four case areas, social networks, made of friends, family and colleagues, constitute a quite strong knowledge basis that is drawn on for performing renovations.

Maybe the Latvian study shows the most coherent case on the way to create a new practice of retrofits: its energy-inefficient building stock, cold winters, a majority of homeowners feeling the cold (a more unacceptable feeling given the current norms on comfort) and homeowners’ inability to pay for increasingly expensive energy, all converge to require urgent retrofitting.

The third question raised by this research is about the role of the EPBD in constituting a practice of energy-related renovation. A problem in this respect is that the aim of the EPBD is to label buildings, with procedures varying according to country/region. At the same time there is an aspiration to compel persons (e.g. homeowners) into a (still non-existing, as argued here) practice of energy retrofitting. This discrepancy contributes to explaining why the EPBD’s present execution does not strongly influence the formation of a retrofit practice. Furthermore in 2009–10, the
EPCs were not related to other institutionalized rules in the four studied countries/regions, which lowers their potential impact. As an isolated market instrument aiming at informing and raising the awareness of the general public, the EPCs could not play a major role in the creation of a retrofit practice.

This analysis of energy retrofits in four European countries/regions based on social practice theories also opens the way for recommendations on energy policy in at least three ways, which can be combined: by integrating practices that are otherwise disparate, by strengthening the components linking doings and sayings, and by reinforcing the interdependence between components. In the first category, a new Walloon policy instrument, called the ‘eco-pack’, is worth mentioning. It provides access to regional subsidies and no-interest loans on condition that at least two energy-saving renovations are performed, and some may be performed by the homeowner or the tenant. The subsidies are higher for a ‘bouquet’ of at least two energy-saving works than for the same works performed separately, and for lower-income households.

Another recommendation for integrating different energy-related renovations would be the creation of educational programmes specialized in energy retrofits, or at least in different techniques for insulating roofs and walls. For continued training, the creation of the Knowledge Centre for Energy Renovation of Buildings in Denmark since 2008 seems promising, as shown in an evaluation of the activities (Tokeby, Bundgaard, & Larsen, 2012). These new training activities would improve and integrate professionals’ know-how, whereas to increase the public’s practical knowledge community learning projects could also be supported by authorities (see also Karvonen, 2013). In the same line of thought, integrated business in insulation and energy savings could be developed as examples observed in Wallonia (DIY retailers of environmentally friendlier products, contractors for all types of insulation work and a consultancy), and this might be supported by authorities. In some Danish municipalities, the local authorities have formed public–private partnerships with local companies for strengthening the companies’ competences in energy-related renovations.

Other recommendations arising from this research are to strengthen the components linking doings and sayings. Regarding the institutionalized rules, the influence of the EPC may be reinforced if the EPC is explicitly related to other rules. Bulgaria shows a way of linking EPCs and fiscal law, as buildings with energy certificates of classes A and B are tax-exempt, which is considered by many Bulgarians as an attractive stimulus for energy-related renovations (Gosselain et al., 2011, p. 1332). Another example is to make the EPC a mandatory prerequisite for obtaining public subsidies or no-interest loans for energy-saving renovations, as is currently the case in Wallonia.

To structure the engagement basis of such a possible practice of retrofits, values largely shared should be associated, e.g. by the media, public authorities or non-governmental organizations (NGOs), to energy-related home improvements, these values being comfort, cosiness, healthy lifestyle, as well as local employment, individual autonomy (for renewable energy). This would contribute to overcoming the lack of social norms about energy retrofitting and making it more mainstream and valorized. However, a danger when advocating retrofits framed by comfort rather than by energy savings is that it might contribute to increasing norms of comfort at the loss of energy savings (the rebound effect, e.g. heating more space, demanding higher temperatures and/or prolonging the heating season) as shown in a study dealing with the introduction of heat pumps (Gram-Hanssen, Christensen, & Petersen, 2012). Other engagements such as environment and climate protection appear to be rather disconnected from energy-related renovations in fast-changing Eastern European countries advocating liberalism and individualism, as shown for Latvia and Bulgaria by Bartiaux et al. (2011).

Regarding the technical component, to have an impact the EPBD should be suited to a higher degree to the local material structure, e.g. the building stock. In Denmark, the EPCs have the longest implementation but have little impact, as they are not considered an important part of the knowledge on retrofits. In line with Watson and Shove’s (2008) findings, technical research should be encouraged to develop convenient and easy-to-use energy-saving products for DIY practitioners and neophytes.

Social practice theories also call attention to the interconnections between components and their co-evolution, as also shown by Shove (2003). The technological and institutional components can be mutually strengthened as seen namely in Latvia, where one state programme was recently implemented to co-finance with house owners renewable-energy projects such as solar panels, wind turbines and biomass boilers.

The knowledge and engagements components could be both enhanced. This research has shown how important the knowledge networks are in orienting and sustaining energy-related renovations. A recommendation to the authorities for encouraging energy retrofitting thus could be to support financially collective approaches to sustainable renovation by neighbourhood. A call for such projects was launched by the Walloon authorities in 2012. In linking the engagement structure and the institutionalized rules
expressed in the EPCs, encouragement in receiving a higher label could be developed. In Denmark, recent research suggests that higher energy labels do positively influence the sales price of the house (Jensen, Kragh, & Hansen, 2013). Such evidence has also been discussed in the media to some extent and underlined by real estate agents, and it may contribute to establish an engagement structure of energy-related renovations.

Finally, one theoretical contribution of this research is to suggest that practice theories would need to pay more attention to and theorize the role of social interactions and networks in creating and sustaining a practice (see also Bartiaux, in press). Indeed in each of the four case areas there are exchanges of advice, networks of knowledge or of practical help about energy-related renovations, and more theoretical and empirical research is needed on this topic.

Conclusions
Energy-related renovations have been analyzed here with a conceptual framework drawn from social practice theories, and this approach has yielded several results. Firstly, to be understood – and later eventually promoted – energy retrofits must be socially contextualized and comprehended as a result of co-evolving know-how, laws and other institutionalized procedures, social norms, and technologies and products. Without this co-evolution, first highlighted by Shove (2003), no new or changed practice may be formed. The European EPBD associated with the national or regional EPCs is no exception: EPCs do not create a practice of energy-related home renovation by themselves. A social practice cannot be created by a law or a European Directive before being sustained by common and conventionalized routines, both mental and behavioural, and shared know-how and ends.

Secondly, this analysis confirms that energy retrofits are not a question of giving homeowners the ‘right’ information and motivating them, as technological and economic models assume. Homeowners thus should be seen not as isolated individuals who should ‘choose’ to carry out energy-related renovations but rather as ‘carriers’ of social norms of what is normal to do and say, and of established routines and know-how.

Thirdly, an important similarity in the four countries/regions studied here is the importance of knowledge networks in providing advice and help before and during the renovations. Homeowners’ social networks include specialist craftsmen/tradesmen, and these relations also shape the ways in which energy-related renovations are carried out, or not. Energy-related renovations are not only a technical issue, but also a topic of conversation and a matter of trust and friendship.

Fourthly, this analysis based on social practice theories shows the way for novel recommendations on energy policy that are directed to the social context of energy-related renovations rather than to individual house owners. As outlined above, these recommendations are of at least three types: subsuming and integrating practices that are otherwise disparate; strengthening the components linking doings and sayings; and reinforcing the synergies between two or more components.

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**Endnotes**

1 In 2008–11, the IEE funded the IDEAL-EPBD research project (Improving Dwellings by Enhancing Actions on Labelling for the Energy Performance in Buildings Directive) (see http://www.ideal-epbd.eu).

2 The SEREC research project (Socio-technical Factors Influencing Residential Energy Consumption) was financed in 2004–06 by the Belgian administration for research policy. It included a comparison of households with energy labels in Denmark and Belgium (Bartiaux et al., 2006; Gram-Hanssen et al., 2007).

3 Most fiscal rebates were suppressed in 2012 by the Belgian federal government.