Energy Policy 106 (2017) 212–221

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

The rationale for energy efficiency policy: Assessing the recognition of the multiple benefits of energy efficiency retrofit policy

Niall Kerr[a,*], Andy Gouldson[b], John Barrett[c]

[a] Infrastructure Business model for Local Delivery (I-Build), Sustainability Research Institute, School of Earth and Environment, University of Leeds, UK
[b] ESRC Centre for Climate Change Economics and Policy, School of Earth and Environment, University of Leeds, UK
[c] Sustainability Research Institute, School of Earth and Environment, University of Leeds, UK

ARTICLE INFO

Keywords:
Efficiency
Retrofit
Multiple-benefits
Agenda-setting
Policy rationale

ABSTRACT

The rationale for energy efficiency policy can be framed in terms of a variety of different benefits. This paper considers how different benefits have been used within the overall rationale for energy efficient retrofit policy in different contexts. We posit that different rationales may be used for the same policy response, and that the form of rationale used may affect the design, delivery or the level of policy support, with different rationales making it easier to account for different results. Considering retrofit policy in the contexts of the UK, Germany, New Zealand and Ireland, we characterise policy rationale in each case, assessing what the key perceived benefits have been, and whether they have changed over time. The analysis identifies some marked differences between cases with the recognition of benefits and the ensuing policy rationale resulting from a complex mix of political, social and economic influences. We find that recognition of multiple benefits may not equate with multiplied policy support, and instead it is more likely that different rationales will have relevance at different times, for different audiences. The findings highlight that, alongside evidence for policy, it is important to also consider how the overall rationale for policy is eventually framed.

1. Introduction

The more efficient use of energy is a policy concern in a variety of countries, for a variety of reasons. The International Energy Agency (IEA) has in recent years tried to highlight the importance of energy efficiency (EE) to its member states and to give it more priority has reframed it from being a 'hidden fuel' to being the 'first fuel' (IEA, 2014a). This focus is in part due to the perception that demand-side energy policy options have been overlooked in favour of supply-side options (Lazar and Colburn, 2013; Verbruggen, 2003) with a resultant bias toward investment in energy generation over energy demand reduction (IEA, 2015). The IEA estimate that with existing levels of policy support, two thirds of economically viable energy efficiency potential will remain un-tapped by 2035 (IEA, 2014b). The perceived lack of support for energy efficiency is attributed to a variety of its inherent features, including, the nature of its measurement i.e. measuring a negative value (energy savings), the resultant level of return on investment being considered very uncertain, and to the potential for various related rebound effects (Keay, 2011; Sorrell, 2015).

The apparent disregard for EE has resulted in reporting, directed at policy-makers, which focuses on its different perceived *benefits*. Reporting sometimes presents fresh evidence of benefits (Copenhagen Economics, 2012; Washan et al., 2014), and at other times synthesises existing evidence to present the case for policy support (IEA, 2014b; Lazar and Colburn, 2013). Many argue that there are multiple different benefits, and therefore potentially multiple different reasons for EE to be on the policy agenda, and some advocate a "multiple benefits approach to energy efficiency policy" (IEA, 2014b), highlighting that the perceived benefits are often not recognised equally or consistently in different national contexts. Ultimately this reporting seeks to expand policy makers' perspective beyond the existing rationale for policy, to include a recognition of additional benefits and thus potentially alter the associated policy support.

In light of calls for policy makers to recognise EE's 'multiple benefits', this paper will assess how much a selection of its perceived benefits have been used as the rationale for EE policy. We focus on a prevalent form of EE policy – energy efficiency retrofit of existing domestic buildings – and consider a selection of different national policy contexts. With activity in domestic buildings often responsible for a large proportion of overall national, territorial energy use (IEA, 2014a; Lucon et al., 2014), and existing building stocks forecast to compose the majority of the future stock for many decades to come in developed countries (Lucon et al., 2014; Royal Academy of Engineers, 2010; Schröder et al., 2011) energy efficient retrofit has moved onto the policy agenda of a variety of countries in recent years.

* Corresponding author.
E-mail addresses: n.kerr@leeds.ac.uk (N. Kerr), a.gouldson@leeds.ac.uk (A. Gouldson), j.r.barrett@leeds.ac.uk (J. Barrett).

http://dx.doi.org/10.1016/j.enpol.2017.03.053
Received 7 December 2016; Received in revised form 16 March 2017; Accepted 24 March 2017
0301-4215/

The paper considers the extent to which the perceived benefits of carbon emission reduction, health/fuel poverty impacts, employment/fiscal effects and energy security have been employed as the rationale for retrofit policy, in the contexts of the UK, Germany, New Zealand and Ireland; 4 countries with similar economic and climatic backgrounds, where retrofit policy has existed for a number of years.

The paper seeks to describe the mix of perceived benefits that have been used in the overall rationale for policy, helping to bring retrofit on to the policy agenda in recent years. We attempt to explain why the perceived multiple benefits of energy efficiency retrofit may yield different rationales for the same policy response, in different national contexts. We also consider how the rationale may change over time and to what extent the multiple reasons for policy help to achieve multiplied policy support. Finally we consider whether the form of rationale used might influence the scale and substance of the policy implemented.

To achieve this, the paper firstly sets out the theories of agenda-setting that are used to structure the analysis. We then assesses the relevant background of each country, looking at its building stock, building energy use practises, existing policies and associated policy targets. We begin the assessment of policy rationale by considering the formal, stated reasons for policy as set out within policy impact assessments and related policy literature. We then expand on the formal rationale by carrying out a set of semi-structured interviews with relevant experts, and by considering other academic and grey literature from each country. The analysis seeks to contribute to the agenda-setting literature by considering how a particular policy response - retrofit - can be associated with potentially multiple policy benefits, and how this framing might influence its place on the political agenda.

2. Background

2.1. From co-benefits to multiple benefits

The benefits that are perceived to result from a particular policy response are contingent on the social, economic and political environment, the period of time in question and the actors involved. The idea of a policy response having a primary purpose, as well as a less recognised set of additional or ‘co-benefits’, has been seen in relation to climate change policy for a number of years (Aunan et al., 2004; Jakob, 2006; NEAA, 2009; Younger et al., 2008). The concept has a variety of handles including hidden benefits or non-energy benefits (ISSP, 2011; Schweitzer and Tonn, 2002), and its reporting has been cited as a means of improving the political acceptability of climate policy (Smith, 2013).

The identification of the co-benefits of climate policy has evolved in recent years into the framing of energy efficiency in terms of its ‘multiple benefits’, where there is not necessarily an emphasis on any particular benefit. The case for recognising the multiple benefits of energy efficiency has been made by multiple organisations (see ACEEE, 2015; ECEEE, 2014; IEA, 2014b; Lazar and Colburn, 2013; Ryan and Campbell, 2012), with some reports focusing specifically on the multiple benefits of retrofit (see Copenhagen Economics, 2012; Washan et al., 2014). A single policy issue being associated with a wide variety of benefits is a framing that is seen in relation to other policy areas, for example, with regard to cycling provision and hydraulic fracking (EAC, 2014; Raje and Saffrey, 2016).

2.2. Policy problems, policy solutions and the political agenda - Streams within a stream

What is considered a policy issue is “not self-evident”, it may be contested, subjective and socially constructed (Wolman, 1981), whilst public policy *formulation* is notoriously inscrutable (Wu et al., 2012). “The cast of people trying to influence Government is vast”(Rose, 2005), with actors in the cast coming from within Government – the department facilitating the policy, the department controlling spending, relevant committees etc. – as well as external actors like lobbying NGOs and private companies. Actors may use evidence of the benefits of energy efficiency strategically, in order to aid their potentially predefined positions (Bernauer et al., 2004; Hertin et al., 2009). The process of assessing whether the reported benefits of policy form part of the rationale for a policy may be similarly inscrutable and non-self-evident (Kingdon, 1995).

In the vernacular of energy efficiency advocacy, different reasons for policy are articulated using the language of ‘benefits’. Another way of viewing these ‘benefits’ is as policy problems to be addressed. Kingdon's (1995) seminal multiple streams framework for agenda-setting sets out that policy problems, policy solutions and political will are ‘independent streams’ which need to converge and create a ‘policy window’ in order for a particular issue to reach the political agenda (Sabatier and Weible, 2014). In light of the emergence of the multiple benefit framing of energy efficiency and in line with Kingdon's multiple streams framework, the analysis here considers the potential for multiple, diverse, policy problem streams - multiple benefits - to converge with a single policy solution stream – retrofit – to excite political will and move an issue onto the political agenda.

Using the logic of *agenda-shaping* (Tallberg, 2003), we consider the influence of the different policy problems on both bringing retrofit to the agenda – agenda setting – and on emphasising or de-emphasising retrofit's place on the agenda – agenda structuring – critically considering the policy dynamics (Baumgartner et al., 2006). In order to relate to the theoretical framing in this analysis we refer to retrofit policy as a ‘policy solution’, we do not, however, infer that any of the policies considered have *solved* their associated policy problems.

With the potential for multiple problems being associated with a single policy solution, we also consider whether the principle of ‘problem load’ – conventionally used to describe the bounded nature of the number of policy problems that can be addressed by policy makers at one time (Sabatier and Weible, 2014) – has relevance to the multiple benefit framing, and whether there is a limit to the number of problems that can be acceptably associated with a single policy solution at one time.

Finally, with there being potentially multiple reasons contributing to a single policy solution's overall rationale, we consider whether the rationale for policy may affect the scale and stability of the policy itself. The perceived benefits of retrofit cover a wide range of policy issues – here we focus on carbon emission reduction, fuel poverty/health, employment/fiscal effects and energy security. In this analysis we will compare rationales in terms of the extent to which they can be considered as economic – influencing the overall size of the costs and benefits and potentially ‘adding value’ to the economy – or as social – affecting matters of equity or how the costs and benefits are distributed. Although each of the perceived benefits highlighted for analysis here can be advocated in both economic and/or social terms, *the overall rationale and the policy design* may offer insights into the extent to which policy is expected to provide an economic return, or to address matters of social equity. As Radaelli observes with regard to the use of policy assessments “If more than one logic is at work… it becomes easier to account for different results” (Radaelli, 2005).

3. Methods

3.1. Case study criteria

Retrofit is more commonly a concern in countries were existing domestic buildings are relatively old and are expected to comprise the majority of the stock for many years to come. This analysis will be restricted to countries where retrofit of existing buildings is a higher priority, and which have similar economic backgrounds. In line with the IEA's calls for a greater appreciation of the benefits of energy efficiency in policy decision making, the analysis will focus on IEA member countries, those within the OECD.

Alongside this, we will consider case studies that have a similar climate and therefore requirement for similar forms of retrofit. In the countries of Northern and Central Europe, around two thirds of energy used in a home is used to heat spaces (Economidou et al., 2011), and thus retrofitting the building fabric is more prevalent. Due to the predominance of OECD members in temperate regions such as Northern and Central Europe, case studies will be restricted to those within a temperate climatic region. The final criterion for case studies applies to availability of evidence on policy rationale, with a selection of countries with the best available evidence considered. The analysis will therefore assess the rationale for policy in the UK, Germany, New Zealand and Ireland, with a focus on the period between 2005 and 2014.

3.2. Methods for case study comparison

3.2.1. Background and policy support

The analysis will begin by outlining some details for each country that are relevant to the comparison. These include the state of their building stock, sources of building energy use, and the main policies and targets associated with retrofit. There are a variety of different methods of retrofit policy support. Financial support requiring funds from central government and/or leveraged funds from the private sector (e.g. Energy Supplier Obligations), may exist alongside non-financial mechanisms such as regulation or information based systems (RAP, 2010). As there are both financial and non-financial policy levers, levels of policy support cannot be judged solely on the amount of funding that is allocated. Levels of funding, however, can give some impression of the level of policy support, particularly in terms of changes over time (Baumgartner et al., 2006). In each case study an estimate of the level of historical funding support will be given, as one method (by no means comprehensive) of comparing levels of policy support with the rationale for policy. We will also consider how the case studies compare in terms of non-financial policy.

3.2.2. Assessment of policy rationale

This process begins with a review of relevant policy impact assessments (IA). Despite being an attempt at a rational, instrumental approach to policy, IAs can vary significantly between countries (Radaelli, 2005). Whether they are ex-ante (before) or ex-post (after) policy implementations IAs regularly attempt to assess a policy's costs and benefits, either quantitatively or qualitatively. The analysis considers what benefits are included within each national IA; whether benefits are included quantitatively, as part of a cost benefit analysis, qualitatively or not at all. The analysis takes the view of Ackerman that in cost benefit analysis quantified benefits are valued more highly than non-quantified benefits (Ackerman, 2008). There is a long-standing critical literature on the role of these assessments, and whether they constitute 'evidence based policy', or 'policy based evidence' (Bina, 2002; Hertin et al., 2009). Due to the established misgivings, this analysis will consider the IAs to offer only a preliminary view on what the rationale for policy might involve, and to be by no means a comprehensive account of policy rationale.

Following this, additional government literature is examined to assess the policy design, and consider how this relates to the rationale for its existence. By doing this we seek to assess the revealed preferences of the policy, in comparison to the stated preferences of the IAs. For example, one policy may be designed to target the maximum carbon savings, while others may prioritise certain social groups with the benefits from the rebound effect in mind (Vivanco et al., 2016).

Finally, the analysis involves a set of expert interviews – actors involved in policy development and evaluation, or academics involved with the evidence process – for each case study (for description of interview process see Annex). Interviews were expected to offer a more insightful view of the overall rationale than that offered in the formal declarations of the IA (detail on the structure of the interviews is given in the Annex). The perceived benefits focused on in this analysis – carbon emission reduction, health/fuel poverty benefits, employment/fiscal effects and energy security – were chosen after being considered the most prominent categories of benefits in the retrofit and multiple benefits literature.

The analysis is not concerned with whether the perceived benefits of retrofit are real or not, but with the extent to which they are considered to be the policy problems associated with the retrofit policy solution. We accept that with regard to the existence and level of policy we are not capable of "exercising control over all the historical and contemporaneous, macro- and micro- conditions, that have influenced the situation we wish to explain" (Pawson, 2006) and that the scope for associating causes and effects in macroeconomics is limited (Lawson, 1997). We instead try to assess the 'big picture' of policy rationale, the extent to which the same policy solution can be associated with multiple policy problems and what the implications of this may be (Table 1).

Table 1
Interviews conducted.

Case study	Number	Interviewee description	Date of interview
UK	1a	UK University, Energy policy expert	13th January 2016
	1b	UK Government, Economist	14th January 2016
	1c	UK Government, Researcher	22nd January 2016
	1d	Retrofit consultant, UK expert	26th January 2016
Germany	2a	UK University, retrofit policy expert	11th December 2015
	2b	German Energy Research Institute, Energy expert	28th January 2016
	2c	German Energy Research Institute, Energy expert	5th February 2016
New Zealand	3a	NZ University, Buildings/Energy expert	24th November 2015
	3b	NZ University, Buildings/Energy expert	3rd December 2015
	3c	Policy Research Institute, Research Fellow	8th December 2015
	3d	Former Member of NZ Parliament	11th December 2015
Ireland	4a	Irish Energy Institute, Researcher	6th January 2016
	4b	Irish University, Energy Economist	15th January 2016
	4c	UK University, Energy policy expert	19th January 2016
	4d	Irish University, Economist	11th February 2016

4. Results

4.1. UK

4.1.1. Background and policy support

The UK has one of the oldest building stocks in Europe (Economidou et al., 2011), with the stock considered poor in terms of thermal performance by European standards (ACE, 2015). The vast majority of homes are heated via a gas grid (DECC, 2015), which was largely constructed in the 1970/80 s, when the UK was a net exporter of oil and gas. Since 2004 it has been a net importer with the data for 2012 showing that 60% of gas was imported (DECC, 2013). Electricity generation in recent years has been supplied with roughly 30% contributions from coal and gas, 20% from nuclear and renewables up to 20% in 2014 (DECC, 2014). Retail energy prices have risen significantly above the rate of inflation since 2005 with a slowdown in the last 2 years (IEA, 2016a). Carbon reduction targets peak at 80% in 2050 (1990 baseline), while targets also exist for 'fuel poverty' - originally to eradicate it by 2010, (DTI, 2001) with a lack of success leading to a less ambitious target for retrofit improvements from 2012 (Hills, 2012).

The main policy encouraging retrofit has been subsidies made from Energy Supplier Obligations (ESO). Low levels of ESO were in place in the UK since the privatisation of the energy sector in the 1990s, with significant increases in 2005 and 2008. In 2012 the Energy Company Obligation (ECO) was joined by a new financing scheme, the Green Deal (GD) (Rosenow and Eyre, 2013). The level of obligation within ECO was effectively halved in 2013, partly due to concerns it was having an inflationary impact on energy prices – the cost of ESOs is passed onto energy bills (ACE, 2014a) – while the GD was effectively scrapped in 2015 partly due to a lack of uptake (Rosenow and Eyre, 2016). ESOs have normally had around 50% of their spending focused on priority social group's i.e. low income and elderly. Non-financial policy mechanisms include EU mandated Energy Performance Certificates (EPCs), and brief and limited regulation of the private rental sector, while there are no regulated performance standards for retrofit.

4.1.2. Assessment of policy rationale

The ex-ante IAs for retrofit policy involve quantifying the benefits to be included in a Cost/Benefit Analysis (CBA), and identifying 'wider impacts' which are not quantified. Quantified benefits include energy savings, air quality improvements, comfort benefits and carbon savings benefits, while the wider, non-quantified impacts include potential health benefits (DECC, 2012, 2010). The IA estimates the number of jobs associated with the policies, with this measurement made for jobs 'supported', rather than an estimate of any net change in employment levels (jobs created). Retrofit policy's positive impact on improving the security of UK energy supply is mentioned several times.

The considerable increases in ESOs seen in 2005 and then 2008 were mainly attributed by literature and interview sources (Carter and Jacobs, 2014; Rosenow, 2012) (interviews 1a, 1b) to concerted efforts to reduce carbon emissions. This effort can partly be seen in the ESO policy's name change in 2008 to include the word 'carbon'. The issue of fuel poverty is, however, also seen as a critical driver in the UK at this time, with some interviewees putting it or 'social concerns' as a more important motivation than carbon (1d). Another interviewee attributed the increases of 2005 and 2008 predominantly to the carbon driver, but the extension in the scheme from 2010 to 2012 at the same funding level, to the increases in energy prices around this time, and resultant concerns around the affordability of energy and thus fuel poverty (1a). Further emphasis on fuel poverty (at the expense of carbon), was observed by literature sources (Rosenow et al., 2013b), and can also be seen in the alteration of the ESO scheme announced in late 2013. The perception that ESO policy acts to increase energy bills was a major factor in the significant reduction in ESO funding, with the cut occurring to the carbon section of the policy, rather than the socially focused, fuel poverty section (ACE, 2014b). The shifting rationale for ESO policy has been linguistically consolidated by the decision to call the scheme the Fuel Poverty Obligation from 2018 (DECC, 2016).

The rationale for retrofit policy in the UK comes predominantly from carbon reduction and fuel poverty alleviation. The quantified comfort benefit in the IA is recognition that the impacts of retrofit may transpire as a warmer home rather than energy/carbon savings. The specifically health impacts of retrofit, including any reduction in public health spending, are not felt as keenly with health impacts an unquantified wider impact in the IA.

The potential employment impacts of policy are included in the IAs as jobs supported rather than created. The idea of retrofit policy resulting in job creation "needs to be treated with caution" according to a government source (1b), with the scepticism of a single policy having a positive impact on net employment attributed to "treasury orthodoxy" (1a). There was little sentiment from the interviews that the potential employment benefit of retrofit is one which "cuts much ice in the UK" (1a, 1d). Other sources observe the energy efficiency industry increasing their lobbying influence since the expansion of ESOs (Rosenow, 2012), with recent attempts to redefine retrofit as an infrastructure priority (Frontier Economics, 2015; UK Green Building Council, 2013) partly an attempt to highlight the employment benefits of retrofit.

Despite being regularly mentioned in the IAs energy security was considered to have been a neglected influence on retrofit policy by the interviewees, with only one raising the issue as relevant to the rationale for policy (1d).

4.2. Germany

4.2.1. Background and policy support

The current German building stock has an age profile similar to the EU average. Energy performance of the stock compares favourably with countries of a similar climate (Economidou et al., 2011). Around half of heating demand is met by gas, about a quarter by oil and the rest from renewables and district heat (BMWi, 2015). Electricity, historically, has come from a mix of fossil fuels and nuclear similar to that of the UK, with a broad mix of renewable sources gradually increasing their contribution – around 25% in 2013 (IEA, 2016b). Similarly to the UK, Germany currently has a negative energy trade balance, (roughly 60% of energy is imported) although this balance has existed for much longer than it has in the UK (Schröder et al., 2011). Retail energy prices have increased above the rate of inflation in recent years but not at the level seen in the UK (IEA, 2016a). The term Energiewende, or Energy Transition, refers to the process of phasing out nuclear power and eventually fossil fuel generation from its energy portfolio. Energiewende's origins can be traced back several decades, and it is perceived to have a broad political consensus (Hake et al., 2015; Strunz, 2014), with legislated targets including an 80–95% reduction in carbon emissions, and a 50% reduction in primary energy use by 2050 (Agora Energiewende, 2013).

Retrofit policy support comes predominantly in the form of a low interest soft-loan system, the CO_2 Buildings Rehabilitation Programme (CBRP), with public funds administered by the KfW development bank. The interest rate is partly determined by the level of retrofit that is to be carried out, with lower rates on offer for loans that are used to achieve deeper retrofits. Grants were introduced to the scheme from 2007, but have comprised a low amount of funding in comparison to subsidised loans (Rosenow et al., 2013a). Retrofit funding is linked to central government budgets, with funding support increasing markedly after 2005, peaking in 2009 and then stabilising at a more consistent level (Dorendorf, 2013). Retrofit policy in Germany does not have a targeted social focus, with no funding ring-fenced for certain social groups. The loan mechanism allows for significant leveraging of private investment, something which is not typically achieved as much by grant funding.

This system means that CBRP is associated with tens of billions of euros more retrofit investment, than the public funding alone (Rosenow and Galvin, 2013). German policy includes regulation – Energy Saving Ordinance – which sets performance requirements for major retrofit projects (Galvin, 2012). While it offers an information based policy system that includes EPCs and is like many other countries in the EU (Riccardo-AEA, 2015).

4.2.2. Assessment of policy rationale

The CBRP scheme is subject to an IA each year with the overall energy/carbon savings and the jobs figures calculated. Jobs figures receive significant attention being disaggregated into direct and indirect jobs in the construction, materials and services sectors as well as an urban and rural disaggregation. There is no mention of health or energy security benefits, but there is a consideration of the impact on tax revenues (IWU, 2014). The IAs provide regular feedback on the policy's performance but some interviewees expressed concern about how rigorous they were (2a, 2c).

Retrofit policy has existed in Germany over a similar timeframe to that of the UK. Like the UK the word carbon has been included in its title, but unlike the UK, this reference has been a continuous presence from retrofit policy inception to the present day. Loans are given on the basis of achieving a certain level of carbon (not energy) saving (Rosenow, 2013). The emphasis on overall saving level, and no part of the scheme that targets certain social groups, arguably highlights a scheme more carbon focused than the UK equivalent.

It has been suggested that the 'sub-objectives' of German climate policy are economic stimulus and job creation (Kuckshinrichs et al., 2010; Schröder et al., 2011). KfW commissioned research says that policy funding forms 'part of the government's economic stimulus package and hence also had a political and economic motivation' (Jülich, 2011) In analysis carried out in 2011, Rosenow assessed the politics of the CBRP scheme, and found a majority of interviewees observing that politicians see the policy as having positive economic effects and creating jobs (Rosenow, 2013). The interviewees in *the analysis here* overall were unsure of the influence of employment creation on the policy over the longer term, with some perceiving it as "secondary to carbon reduction" (2c) and some as actually "not that important" (2b).

The potential impacts on health are not mentioned in the policy IA. They are not part of the rationale for policy at all in the view of some interviewees (2a, 2c) but are becoming more important in recent years according to others (2b). This lack of a specific social focus within retrofit policy was partly attributed to the significance of Wohngeld policy, where the heating bills of certain social groups are covered by the state (2c).

Even in Germany "a big energy user, with little internal supply" (Schröder et al., 2011) the issue of energy security was not considered to play much of a role in retrofit policy rationale. All interviewees pointed out that at sporadic points in the past, geo-political tensions have given rise to some concern, but that this concern was fleeting (2a, 2b, 2c) (Fig. 1).

4.3. New Zealand

4.3.1. Background and policy support

According to various sources, NZ homes are poorly constructed and heated, with 84% of homes estimated to have inadequate insulation in 2005 (Howden-Chapman et al., 2005; Telfar-Barnard et al., 2011). It is estimated that only 34% of energy in domestic buildings is used for space heating, with 29% for water heating and the rest electricity (Isaacs et al., 2010). This proportion of energy used for space heating is much lower than the other case studies (where around 60% of domestic energy is typically used) (Economidou et al., 2011). This situation has been partly attributed to a lack of central heating and cultural attitudes in NZ (Cupples et al., 2007; Howden-Chapman et al., 2012). Space heat is provided by solid fuels (56%), electricity (24%) and gas (14%) (Grimes et al., 2011). but low amounts of space heating in the domestic energy mix, mean electricity is of greater importance to overall energy use, with the price of electricity increasing much faster than inflation since 2000 (IEA, 2016a). While there is a GHG reduction target of 50% (below 1990) by 2050 (Government of New Zealand, 2011), around 50% of emissions come from agriculture, and around 70% of electricity generation is renewable (MBIE, 2015), meaning that emission reduction targets have less relevance to the housing sector than in some other countries.

The Energywise Home Grants scheme was launched in 2004 with a solely low income focus, and insulated 14,000 homes in 2008/09 (Denne and Bond-Smith, 2011). In 2009 the more ambitious Warm Up NZ was introduced, which had the target of insulating roughly 200,000 homes over its lifetime (Grimes et al., 2012). WUNZ is a grant scheme using central government funds, with roughly half of grants between 2009 and 2013 reserved for low income groups (Denne and Bond-Smith, 2011). The second round of WUNZ, started in 2013, was exclusively reserved for priority social groups. In the period of analysis there were both information campaigns and loans made available to promote retrofit in NZ, but these did not receive much public subsidy. Regulatory measures applied only to appliance efficiency and not the standard of retrofit (Riccardo-AEA, 2015).

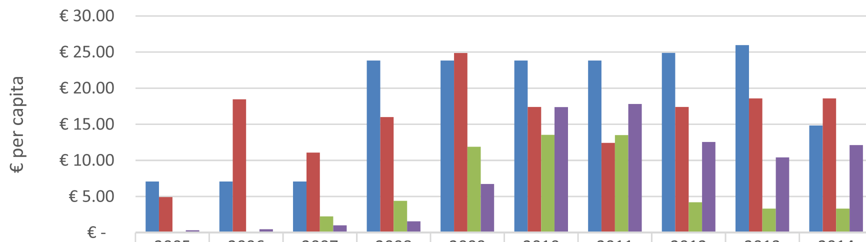
4.3.2. Assessment of policy rationale

The IA of the WUNZ scheme was carried out ex-post and contains real-world estimates of the policy's impacts. The IA entails three distinct reports; one assessing the energy savings, one the health impacts and one the economic and employment impacts (Denne and Bond-Smith, 2011; Grimes et al., 2011; Telfar-Barnard et al., 2011). The commissioning of distinct reports for the wider health and the economic impacts, and no specific report on carbon savings would appear to signal a different set of priorities to that of the assessments in the UK and Germany. The results from the assessments reveal energy savings lower than predicted (Grimes et al., 2016), positive net employment and health impacts that make up 99% of overall benefits (Grimes et al., 2012).

Interviews emphasised that there is a strong link in NZ between retrofitting homes and health benefits, with media coverage of the scheme focusing on these rather than economic or environmental arguments (3a, 3c). Health impacts precede energy savings and employment in the list of objectives in the IA (Denne and Bond-Smith, 2011; Grimes et al., 2012), with this focus partly attributed by most interviewees (3a, 3c, 3d) to longstanding research into the health benefits of retrofitting homes (Chapman et al., 2009; Howden-Chapman et al., 2007, 2005).

The political background to the policy involved negotiations from around 2007, between the Green Party and the Labour Party, in which a home insulation policy was forwarded by the Greens and accepted by Labour. A change in government in 2008 resulted in the initial abandonment of the scheme. The policy was eventually funded however, when Green party activism and support from businesses helped convince the new (National Party) Government that the policy could be used as a means of creating employment (in a time of recession) (3a, 3c, 3d).

The connection between carbon reduction and retrofit policy was made in some interviews (3c, 3d) but it is noteworthy that none of the sub-evaluations of the policy mention carbon and it is not until the summary CBA that it is considered (Grimes et al., 2012). This is possibly a result of the scale of renewable energy in NZ, and the relatively small contribution of buildings to total emissions. Some interviews also attributed it to a reluctance to address climate change in some NZ political parties (3b, 3d). No association between energy security and retrofit policy was raised by interviewees or mentioned in any of the literature for NZ. When prompted on the issue, all interviewees said that it was not something that was part of retrofit



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
UK	€ 7.09	€ 7.09	€ 7.09	€ 23.84	€ 23.84	€ 23.84	€ 23.84	€ 24.88	€ 25.97	€ 14.84
Germany	€ 4.93	€ 18.47	€ 11.08	€ 16.01	€ 24.88	€ 17.41	€ 12.44	€ 17.41	€ 18.59	€ 18.59
New Zealand	€ -	€ -	€ 2.26	€ 4.41	€ 11.90	€ 13.54	€ 13.50	€ 4.21	€ 3.33	€ 3.33
Ireland	€ 0.33	€ 0.48	€ 1.02	€ 1.59	€ 6.74	€ 17.39	€ 17.83	€ 12.55	€ 10.43	€ 12.13

Fig. 1. Domestic retrofit policy budget per capita. **UK data refs:** (ACE, 2015; CCC, 2015; IPPR, 2012; Lees, 2008), **Germany data:** (Buchan, 2012; Dorendorf, 2013; Rosenow, 2013; Rosenow et al., 2013), **New Zealand data:** (Denne and Bond-Smith, 2011; Grimes et al., 2012), **Ireland data:** (SEAI, 2014, 2013, 2012, 2011, 2010, 2009; SEI, 2007, 2006, 2005). Note on Figure 1: the graph was constructed using data from the references outlined above. In some countries, for some years, exact data was not available and assumptions were necessary to achieve estimates of funding. Note on exchange rates: both UK and NZ funding were converted to Euros, with information provided below on the exchange rates used. As a result of exchange rate fluctuation at this time, converted funding levels in the UK and NZ will see changes in their levels that do not precisely correspond with the changes in the levels of funding in each country that would have occurred in their domestic currency. UK exchange rate (€/£): 2005–2008=1.40; 2008–2011=1.15; 2012–2014=1.20, NZ exchange rate (€/NZ $): 2005–2008=0.52; 2008–2011=0.55; 2012–2014=0.60.

policy rationale largely due to a large contribution to electricity from renewables and significant indigenous energy resources for heat.

4.4. Ireland

4.4.1. Background and policy support

Ireland has one of the most carbon intensive building stocks in Europe, producing much more CO_2 per unit area than Germany and the UK. It has, however, a younger stock than Germany and the UK (Economidou et al., 2011). The carbon intensity of the Irish stock can partly be attributed to the widespread use of oil for heat and (despite being relatively new) the poor thermal performance of parts of its building fabric (ACE, 2015). Proportionally, however, buildings contribution to overall GHG emissions is lower in Ireland than it is in the UK and Germany, largely due to a large, methane producing, agricultural sector (EPA, 2016).

Like other countries of a similar economic and climatic background, space heating comprises the majority of energy used in Irish buildings (Economidou et al., 2011). This heat is estimated to be supplied roughly 45% by gas, 45% by oil, 5% by solid fuel and 5% by electricity (Scheer and Motherway, 2011) Electricity is sourced from predominantly gas power stations, with some contribution from coal/solid fuel power stations, and roughly 20% from renewables (Deane et al., 2013). In line with EU policy Ireland has legally binding carbon emission reduction targets, although the residential sector makes up a relatively small proportion of overall emissions because of a large contribution from agricultural emissions (similar to NZ) (EPA, 2015). Since 2005 energy prices have risen much faster than consumer inflation (IEA, 2016a).

Funding support for retrofit in homes comes in the form of a grant system, funded through general taxation. The scheme originated in 2003 with a small fund focused on low income housing. The overall spend from this programme was expanded significantly in 2009 and again in 2010, with increased funding for the low income scheme and the arrival of a universal fund, immediately larger than the low income fund (SEAI, 2004) (SEAI, 2010). In recent years the low income and universal funds have been at comparable levels. Despite the ring-fencing of funds for low-income groups there are currently no fuel poverty targets in Ireland. Ireland has information based policy to promote retrofit that is broadly comparable to the rest of the EU. There is currently minimal regulation for retrofit standards and no subsidised finance scheme (Riccardo-AEA, 2015).

4.4.2. Assessment of policy rationale

An ex-post IA of the Better Energy scheme was carried out by the Sustainable Energy Authority of Ireland (SEAI) in 2011 (Scheer and Motherway, 2011). This assessment quantifies the energy/carbon savings and other pollutant savings, and identifies jobs supported, improved comfort, health benefits as unquantified co-benefits. A fiscal analysis is included which incorporates taxation changes from altered consumption and some account of the fiscal impact of supported employment but does not include any fiscal impacts from health improvements.

Initial retrofit policy in Ireland was specifically for low income homes, it was not until 2008 that a universal fund was created. This initial focus indicates that a fuel poverty rationale preceded any other rationale, a view supported by all interviews. Unlike the UK, however, there is no definition and monitoring of numbers of people in fuel poverty but this may be more attributable to a lack of administrative resource than a lesser recognition (4b).

When questioned on the later rationale for retrofit policy in Ireland, however, all interviewees gave a similar initial response - the existence of EU mandated carbon targets. Overall funding for retrofit policy grew rapidly with the arrival of the universal grant scheme in 2008. This substantial increase in budget is remarkable due to policies of austerity being applied to Irish public budgets at this time (Fraser et al., 2013). The paradoxical increase is partly attributed in interviews (4c, 4d) to the presence of the Green Party in government and more specifically a Green Party MP as the minister responsible for retrofit policy. With similarities to NZ, this funding increase was attributed in interviews to the relevant Green minister, but also to the jobs benefit coming to the fore in the arguments utilised in a time of recession (4a, 4b, 4d). The connection between jobs and retrofit policy is also regularly seen in official documents from SEAI (SEAI, 2014, 2013, 2012).

The issue of energy security was again secondary to other drivers although it was considered to be at least part of the policy rationale in some interviews (4b, 4c). One interviewee argued that there were energy security concerns but these tended to focus on the provision of electricity and were not particularly associated with retrofit policy (4d).

5. Discussion

As mentioned, due to the inscrutable nature of the policy process we have only sought to, and are only capable of, recognising the ‘big picture’ with regard to overall rationale for the adoption of domestic retrofit policy, and the way that different benefits are recognised. The ‘big picture’ rationales for our case studies do, however, reveal marked and interesting points of comparison. Three of the four case studies demonstrated a strong connection between retrofit policy and carbon reduction. The countries with the highest levels of funding available (per capita), Germany and the UK, included the word 'carbon' in their figurehead policy for at least a time. It is interesting to note that the one country that demonstrated the least recognition of the carbon benefit, New Zealand, had the lowest per capita spend. The lack of association between retrofit policy and carbon reduction in NZ could be attributed to a relatively low contribution to overall emissions from buildings, and, potentially, a government which does not prioritise climate change.

The carbon benefit is conventionally addressed in certain quantitative terms, involving measurement and targets. It also involves implicit consequences i.e. the impacts of climate change, in a way that other benefits do not. The targets and consequences provide the carbon benefit with an impetus that is perhaps not seen from any of the other policy problems. Fuel poverty in the UK is the only other policy problem which sees systematic targeting and monitoring. Whether other policy benefits could be addressed in a similar way e.g. reporting retrofit's impact on a health metric, and whether this would be desirable, is a matter for debate (see Rutter and Knighton, 2012).

Health benefits were clearly the main policy problem associated with retrofit in NZ. This can be attributed to a particularly poor housing stock, the impact of research on the topic of health and cold homes and a rapid real term increase in electricity prices in recent years (Howden-Chapman et al., 2012) – electricity represents 69% of all domestic energy use in NZ (BRANZ, 2006). Rising electricity prices have helped to bring energy affordability, and thus the efficiency of the housing stock, into the political spotlight (Howden-Chapman et al., 2012). Energy prices have risen in real terms in every case study considered, helping to bring energy affordability and fuel poverty onto the agenda in some cases. The prominence of the health benefit rationale in NZ is arguably also attributable to the relative lack of recognition of the carbon policy problem in NZ, with this possibly giving prevalence to an alternative policy problem stream; if the proportional contribution of housing to overall NZ emissions was greater, would the main policy problem associated with retrofit be its potential health benefits?

Despite the link between retrofit and health, the concept of *fuel poverty* does not generate the political concern in NZ that it does in the UK (Howden-Chapman et al., 2012). In the UK, fuel poverty has been a political issue for around two decades, with monitoring and targeting taking place over a similar time scale (ACE, 2002). There was no commitment to reducing or eliminating fuel poverty in NZ, and no official monitoring or evaluation. The identification of fuel poverty as a policy issue is clearly somewhat related to public health concerns (Hills, 2012; Howden-Chapman et al., 2012; SEI, 2003). It's most common definitions, however, which focus on income, mean that associated policy should not be seen simply as addressing issues of health but as targeting more general social welfare.

Ring-fencing some funds for certain social groups was seen in the policy design of all countries except Germany. Both NZ and Irish policy began with funding exclusively reserved for certain social groups. NZ moved to a partly universally accessible fund and then returned to the entirely socially focused structure, while the UK and Ireland typically reserve around half of funds for social priority groups. This policy design correlates well with the emphasis on health in NZ, the shared platform of carbon and fuel poverty in the UK and Ireland and the lack of recognition of the health benefits or fuel poverty in Germany. National recognition of health benefits can also partly be seen in the approaches to policy assessment in the different countries; distinct quantified evaluation of the health benefits in NZ, health as a non-quantified wider impact in the UK and Ireland, and no recognition in the German policy evaluation.

The policy problems of fuel poverty and public health can be targeted by retrofit support, but governments also regularly use methods of income support, or fuel subsidies to achieve the same ends. Some form of this policy exists in each of the case studies, but in Germany its existence was used to partly explain a lack of attention paid to fuel poverty and health benefits. Wohngeld policy which provides a heating allowance for some German citizens, coupled with a building stock that is considered to have better thermal properties than the other case studies could explain the lack of any socially focused retrofit funding in Germany. The lack of association between retrofit policy and fuel poverty or health benefits in Germany, should not however be seen as there being necessarily a lack of fuel poverty in Germany (Schultz, 2015; Thomson and Snell, 2013).

The recognition of retrofit policy as a means of supporting or creating employment was keenly felt at different times in Germany, Ireland and New Zealand. The use of the CBRP scheme in Germany as a means of supporting employment and facilitating economic activity is well documented (Jülich, 2011; Kuckshinrichs et al., 2010; Rosenow, 2013; Schröder et al., 2011). The substantial increase in retrofit spending in Ireland in 2009-10, in contrast to the general reduction in public spending, is striking. In both the NZ and Irish examples, the use of the retrofit spending for jobs argument had greater political traction around the time of 2008–2010. In Ireland where recessionary impacts were more pronounced than they were in NZ, the arrival of significantly increased spending on retrofit in 2009-10 were linked to efforts to 'do something about unemployment' (4a). In NZ, the process of making retrofit policy reality was fraught and was ultimately also aided by economic concerns and the job argument being made. Party politics also played a role in both Ireland and NZ where the respective Green Parties were heavily involved with the promotion of retrofit policy. In Germany, the association of employment and retrofit has been relevant outside of the 2008/09 recession, and can be attributed to a political culture of supporting jobs with public policy and the strong voice of the construction sector at a time of declining sectoral employment (Rosenow, 2013; Sommer and Rosenthal, 2012). It is also appropriate to note the characterisation by Hall and Soskice (2001) of Germany as a Co-ordinated Market Economy, as opposed to the Liberal Market Economies of the UK, New Zealand and Ireland. Estimates of jobs supported by retrofit policy are a regular feature of UK IAs, but overall the employment benefit was not viewed as having as much traction in the UK as in other countries. The idea of a single policy resulting in a net employment increase was seen as being met with scepticism by the government treasury (1a, 1b).

Benefits to a country's energy security is arguably the least tangible of the benefits considered here, and thus recognition of it as a rationale for policy can be more difficult. There is repeated mention of retrofit policy maintaining the security of energy supply in all recent policy IAs in the UK, there is one mention in the evaluation of Irish policy, no mention in the evaluation of the impacts of the WUNZ policy or in the KWZ evaluation of the CBRP scheme. In interviews, respondents from NZ all agreed that there was next to no connection between retrofit policy and energy security, largely due to the state of domestic energy sources. While in the UK and Ireland it was considered of some importance – largely due to limited domestic energy resources – but was only considered in one interview (1d) to be a primary motivation for retrofit policy. In Germany it was considered to be of only passing relevance to retrofit policy, at particular moments of pronounced geopolitical tension (2a, 2b, 2c). Despite its secondary nature in German rationale, it was clear from German interviews and literature sources that there is a link between the generally positive political consensuses around EE policy, and historical events such as the oil crises of the 1970s (Duffield, 2009; Hake et al., 2015). Germany has been reliant on foreign sources of energy for longer than, for example, the UK, potentially helping to build an implicit belief that policy support for EE is worthwhile (Table 2).

Each case study considered here offers a distinctive mix of benefits connected to the retrofit policy solution. With the exception of energy security each benefit has at some point had significant influence on the existence of policy. The countries which demonstrated tangible recognition of the most benefits – NZ and Ireland – also demonstrated the smallest amount of funding support for retrofit. This limited evidence would suggest that the relationship between the number of benefits

Table 2
Policy rationale: summary of analysis findings.

	Policy rationale
UK	Carbon and fuel poverty provide the primary rationale.
Germany	Carbon provides the primary rationale for policy, and is joined by the employment/economic activity rationale.
New Zealand	The health benefits provide the primary rationale, supported by the employment and carbon policy problems.
Ireland	Carbon and fuel poverty provide the primary rationale, supported by the employment rationale.

recognised in the overall rationale, and the level of policy support, is much more nuanced than multiple benefit recognition simply resulting in multiplied policy support.

Whether or not there is a limited space for different benefits to be recognised within the overall rationale or a 'problem load' capacity for a single policy solution, is difficult to ascertain as when there was less recognition of a particular benefit there was often a fitting explanation for this. The two countries with the greatest per capita funding and also those highlighted as front-runners in overall retrofit policy (Murphy et al., 2012), the UK and Germany, had significant benefits missing from their rationale – employment/economic benefit in the UK and fuel poverty/health in Germany. The promotion of retrofit as a form of infrastructure in the UK, and work to highlight the existence of fuel poverty in Germany may help to shed light on the extent to which currently unappreciated benefits of policy can be added to a policy's rationale and to what extent this might affect overall policy support. The influence of different benefits at different times offers a further level of complexity to the multiple benefit framing. The employment benefit was most commonly recognised during the 'trigger point' or 'focusing event' (Kingdon, 1995; Pralle, 2009) of a financial recession. While more overtly social benefits like carbon emissions and fuel poverty demonstrate a more gradual recognition, in line with the idea of subsystem spill overs (Rosenow, 2013).

With regards to the form of overall rationale, as mentioned we have limited case studies and cannot draw strong conclusions from our analysis on the nature of the relationship between the overall rationale for policy and the level of policy support. It is, however, interesting to note that the German example, which had the most consistently economic rationale, also had the most celebrated retrofit policy package (Murphy et al., 2012) – high levels of national funding, significant non-financial policy intervention and higher levels of leveraged private investment from a predominantly loan-based system. New Zealand, which had the most identifiably social rationale for policy, had the lowest funding, and relatively minor non-financial policy instruments. From this it could be inferred that a policy framed as offering some return on investment, may be more attractive to a wider range of policy makers, and thus allow for greater funding and wider policy support. Another interpretation would be that it was the lack of association with the carbon policy problem in NZ that resulted in the lowest funding per capita. There are, however, too many influences on policy formation to make strong claims about causes and effects and arguably, in energy policy "the best that can be hoped for is the identification of partial regularities that hold for only a limited period of time" (Sorrell, 2006).

6. Conclusions and policy implications

With rising calls for political recognition of all of the prospective benefits of energy efficiency, this paper seeks to assess the extent to which a selection of these benefits have formed part of the rationale for energy efficiency retrofit policy in a selection of different policy contexts. In the countries considered here, with the exception of NZ, the carbon emission benefit has probably been the predominant rationale. It has, however, normally sat alongside at least one additional benefit in the overall rationale for policy. In the UK and Ireland, concerns around fuel poverty have existed alongside the carbon benefit, with it not always being clear which the bigger influence is.

The case of NZ, where health benefits rather than fuel poverty have been the main rationale used, demonstrates that the process of recognising policy benefits is complex. Both the health benefits and fuel poverty are of limited relevance in Germany, a country considered to be a world leader in retrofit policy. The persistent connection of retrofit with employment and economic impacts in Germany, generating more of an economic rationale for retrofit policy, could help explain why there is a greater political consensus around retrofit policy there. Alternatively, the recognition of benefits could result *from the* consensus, with less political contestation resulting in a wider appreciation of some of its economic effects.

Actors looking to promote retrofit represent different interest groups – for example climate activists, fuel poverty campaigners and construction industry lobbyists - but share a common goal of retrofit policy support. The evidence considered here suggests that there is room for the retrofit policy solution to be associated with multiple policy problems, but that there may be temporal limitations on when benefits can gain traction. Advocates of retrofit policy should bear in mind that recognition of benefits may be fleeting and that a policy being associated with many different benefits may not generate multiplied policy support.

Advocates may also want to consider whether the overall rationale for retrofit frames it more as economic or more as social policy. In a context of austerity or neo-liberal governance, policy that is more ostensibly associated with a financial return may be more attractive to governments with limited budgets and other priorities.

Ultimately policy contexts are thoroughly unique, and political recognition of benefits is at least as dependent on the political and cultural context as it is on the level of evidence presented. Further work should look in detail at particular countries and perform a finer grained analysis of the politics and the use of evidence in different countries over time, considering what benefits had relevance with which political administrations, when and why. Analysis of the relationships between policy mechanisms and benefit perceptions – such as loans and jobs in Germany, and grants and fuel poverty/health elsewhere - is not one properly considered here but is something that could help to shed light on the relationship between policy rationale and policy. With the influence of evidence on policy, and resultant policy responses, routinely scrutinised and frequently contested, this analysis seeks to draw attention to the related issue of how a particular policy response can be rationalised in different ways. How the overall rationale narrative for policy is framed may have an influence on a policy's prospects, and thus the analysis here should have relevance to actors working in a variety different policy areas.

Acknowledgements

The research presented in this paper is part of the I-Build project (Infrastructure Business Models for Local Delivery) which was funded by the EPSRC and the School of Earth and Environment at the University of Leeds. I would like to thank all the interviewees that contributed to the research, and I would also like to thank Theresa Weinsziehr and Tilman Hesse for their assistance with the German analysis.

Annex

Interview procedure outline and questions

Interviews were between 45–60 min and were recorded for analysis post-interview.

They were semi-structured with questions to prompt discussion.

Questions.

- Please tell me what you know about the origins of energy efficiency retrofit policy in your country – when it was first introduced, what form it took then and what the rationale for policy was at this time?
- Please tell me what you know about any changes that have taken place to the policy since its introduction (in chronologic order)?
- Did these changes involve alteration to the scale, the scope or the policy mechanisms used within the policy topic?
- Could you tell me why you think these changes took place?
- Do you think the rationale for policy was the same now as it had been before the changes?

The above questions were repeated until the discussion of policy reached the end point of the analysis period 205–2014. At this point was reached the interviewee was asked.

- Can you please summarise what you think the predominant overall rationale for retrofit policy has been between its inception and now?
  The interviewee was then asked about the perceived benefits of retrofit policy that had not been discussed. If benefit X had not been mentioned then…
- Could you please tell me what relevance you think X had to the overall rationale for policy and how this compared to other benefits that have been mentioned in association with retrofit policy rationale?
  And finally the interviewer listed the pre-selected benefits of interest for the analysis and asked the interviewee
- Which of the perceived benefits of retrofit policy do you think are the most relevant to the overall rationale for policy?

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