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Framing evidence:
policy design for the zero carbon home

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Abstract

In 2006 the UK government announced a move to zero carbon homes by 2016. The demand posed a major challenge to policy makers and construction professionals entailing a protracted process of policy design. The task of giving content to this target is used to explore the role of evidence in the policy process. Whereas much literature on policy and evidence treats evidence as an external input, independent of politics, this paper explores the ongoing mutual constitution of both. Drawing on theories of policy framing and the sociology of classification, the account follows the story of a policy for Zero Carbon Homes from the parameters and values used to specify the target. Particular attention is given to the role of Regulatory Impact Assessments (RIAs) and to the creation of a new policy venue, the Zero Carbon Hub. The analysis underlines the way in which the choices about how to model and measure the aims potentially transforms them, the importance of policy venues for transparency and the role of RIAs in the authorization of particular definitions. A more transparent, open approach to policy formulation is needed in which the *framing* of evidence is recognized as an integral part of the policy process.

Keywords: building regulations, energy policy, evidence-based policy, net-zero, policy design, policy formation, public policy, Regulatory Impact Assessments, zero-carbon

INTRODUCTION

The EU Directive 2002/91/EC on the energy performance of buildings called for the "the application of minimum requirements on the energy performance of new buildings"; a revision of the Directive in 2010 (Directive 2010/31/EU) stated that: "Member States should draw up national plans for increasing the number of nearly zero-energy buildings and regularly report such plans to the Commission." The demand was ambitious, but also extremely ambiguous. Since its introduction, member states have struggled to give content to the concept. In Britain, the focus has been on the formulation of a policy for 'zero carbon homes' from 2016.

This paper focuses on the process of 'translating' the UK target into a set of specific objectives. Whereas much of the literature on evidence and policy depicts evidence as an independent, external input, the case of Zero Carbon Homes (ZCHomes) challenges that image. In the case of ZCHomes, the production of evidence was both essential to the specification of policy objectives and publicly contested. To a certain extent, these features reflect the unconventional location of the policy process, as evidenced by its displacement from ministerial offices to a specially created organisation, the Zero Carbon Hub (ZCHub). But it also points to a more general feature of policy formulation.

From an empirical perspective, the case study poses the questions: "How did the definition of zero carbon homes shift over the course of the policy process?" and "How did the production of evidence contribute to the definition of the policy problem?" From a theoretical perspective, it challenges the tendency in the policy and Energy Construction literature to treat evidence as external and static at the point of use. In their place, it calls for a processual model of the relation between evidence and policy (see below), which pays

attention both to the production of evidence and to the "back-and-forthness of policy decision making" (Monaghan, 2010, p.43). In focusing on the content of the evidence, this paper complements studies of policy makers use of evidence once policies and associated evidence have been finalized (e.g. Simmons, 2015 in this special issue).

The discussion which follows treats the case of ZCHomes as an "extreme" case. The term comes from case study research and refers to instances of a social phenomenon which, while exceptional, may also provide lessons for other cases (Yin, 2009, p.49). The distinctiveness of the policy for ZCHomes lies in the extent to which the initial aims were underspecified as well as in the break with the usual policy process. The paper begins with a very brief overview of the literature on evidence and policy and the two theories, policy framing and the sociology of classifications, which inform the analysis. This is followed by an account of the specification of the concept of ZCHomes, with a focus on the mutual constitution of policy objectives and evidence over time. The paper concludes with lessons for policy making and research into evidence and policy.

LITERATURE REVIEW

Evidence and Policy

Much of the current research on evidence and policy positions the topic in the current political drive for evidence-based policy research (EBPR). This is evident both in political calls for evidence based policy and in trans-national and national requirements for Regulatory Impact Assessments (RIAs). In the UK, Tony Blair (Prime Minister 1997 - 2007) promised to modernize the policy process, privileging 'what works'; while David Cameron (Prime Minister 2010 - 2015) has called for a professionalization of the public sector, using evidence to make it a leaner, more efficient operation (Botterill & Hindmoor, 2012;

Hallsworth, Parker, & Rutter, 2011). In parallel, the European Commission and many

Western governments have mandated the use of RIA's in the formulation of all new policies.

Key markers include: US President Ronald Reagan's executive order 12291 in 1981, the

European Commission First Impact Assessment Guidelines in 2003 and the UK's

implementation of new Impact Assessment guidelines in 2007. Organizationally, EBPR has

been supported by the creation of formal networks, research institutes, corporate research

groups, foundations and governmental organisations (Lenihan, 2013).

A number of features characterise political and academic discussions of EPBR.

These include: 1. the depiction of evidence as radically distinct from politics, 2. the

treatment of evidence as static information which can be adopted or rejected and 3, an

almost wistful aspiration to transform policy making into an apolitical rational decision

making process and a concurrent acknowledgement that it is not. As Ezrahi (1990) and

Porter (1995) have shown, these assumptions can be traced back to an Enlightenment

model of politics and are essential to the promise of evidence and data to produce 'better

policies'. They can be seen in the linear models of policy development which populate

official policy prescriptions (see, for example, the ROAMEF cycle in the UK Treasury's Green

Book, Grice, 2011/2003, p.3). While this view of evidence has been widely criticized (e.g.

Dunlop, 2010; Head, 2010; Hertin, Turnpenny, et al., 2009), it continues to inform the

research agenda around policy and evidence in subtle ways. This can be seen in calls to

improve the quality of data through new and improved methods and the implicit

assumption that better knowledge will minimize the gap between policy and outcomes.

Without contesting these claims, this paper argues that social and political factors are also

always present and need to be taken into account in discussions of policies and initiatives for the built environment.

The contribution of 'processual models' to the analysis of evidence and policy lies in their potential to combine technical, social and political considerations in the study of both policy formulation and evidence production. This approach to the study of evidence and policy was suggested by Monhagan (2010) in his work on adversarial policies. In Monhagan's work, the term 'processual' draws attention to the way in which different types of evidence are or are not taken into account in the policy process. This study expands that focus to an examination of the co-production of evidence and policy definitions over time.

Before proceeding, it is helpful to say something about the concept of evidence, or rather policy evidence. Instead of treating evidence as information which is somehow more 'true' or less 'political' than other types of knowledge, this paper defines it as knowledge produced by a particular set of instruments deployed in a particular set of procedures. Evidence producing instruments and procedures include, amongst others, appraisals, assessments and consultations. This working definition limits the scope of the study to knowledge explicitly produced for a particular policy process (and to the scientific studies which it draws on). It expands the scope of the study from the use of information to the process of its production. In doing so, it shifts the question from: "How does evidence influence policy decisions?" to: "How does the production of evidence overlay and map onto the policy process?" As such it builds on the processual approach identified above, but expands it to include the production and content of the knowledge itself.

Framing and Classifications

The analysis of the policy for Zero Carbon Homes which follows is informed by two related theoretical literatures: political science work on policy framing and sociology of science work on classifications and standards. The concept of 'policy frames' points to variations in the way that specific policy problems are defined and understood by different actors (Rein & Schön, 1996; Schön & Rein, 1995). The concept has mostly been used to analyse conflicts between actors in the policy process. Policy frames limit the range of options which different actors perceive and entertain. They provide the basis for alliances and coalitions; similarly they explain the failure of different actors to agree. For the purposes of this paper a focus on framing provides a different way to think about the relation of evidence and policy. Instead of focusing on how policy actors use (or fail to use) evidence to make decisions, it draws attention to the relation between the way in which policy problems are framed in relevant policy discussions and the way in which they are framed in policy evidence.

The topic of the framing of evidence is addressed by drawing on the sociology of classifications (Bowker & Star, 1999). This branch of the sociology of science and technology has developed in the past fifteen years. Its relevance for this paper lies in the attention which it draws to the myriad of decisions which go into the production of data. These include decisions about what to measure as well as what units to use. Two points are relevant for this discussion. The first concerns the non-giveness or openness of those dimensions. Nothing about energy use dictates that it should be measured in terms physical units (kWh), carbon units ($kgCO_2e/m^2/year$) or weather-dependant spending ($£/m^2$). Similarly, nothing about energy demand dictates that we should focus on individuals rather

than households or buildings or even neighbourhoods. The choices depend on the researcher's and policymaker's questions and goals as well as on the context in which the data is produced and the audiences for whom it is being developed. By extension, classifications never capture everything that is relevant about a particular object and they are subject to change.

The second point concerns the consequences of these choices. Classifications matter because they are associated with different behaviours or ways of acting. For example, UK local authorities treat planning applications differently depending on whether the buildings are designated Grade I, Grade II or unlisted - indicators of their cultural / architectural significances and level of statutory protection.

The analysis which follows traces the shifting definition of ZCHomes from the perspective of the categories which were used to specify the target. More specifically, it traces: the different parameters and values which were considered at different points in time, the issues which led to their proposal and adoption (or rejection) and their circulation across different venues and actors. The aim of the analysis is threefold. First, it provides a particular version of the development of the UK policy for ZCHomes. As for any set of events, there is a near infinite way of telling this story. The more detailed the account, the more complicated it appears. By focusing on the circulation of categories, the version presented herein offers a dynamic, yet schematic account. This perspective privileges the overlay of policy formulation and evidence production. As such, it necessarily sacrifices other important aspects. No claims are made about individual level motivations or understandings; nor does the account address the energy performance implications of different definitions of ZCHomes. The second aim of the story is to explore the contribution

of a processual model to current reflections on the relation between evidence and policy. Finally, the exceptional and experimental nature of the policy process in this case provides an opportunity to reflect on lessons for the future integration of policy making and evidence production.

METHODS

The research for this paper focuses on the overlay of three distinct but interrelated analytic levels. These include 1. the ongoing interaction between policy actors, interests, venues and instruments 2. the ongoing specification of policy aims and 3. the production of evidence which accompanied that policy design process. The first provides a basis to reflect on the specificity of the case, and thus the relevance of lessons for other cases. Following the social constructivist assumptions inherent in both theories, it also provides an initial insight into how and why certain categories came to dominate the framing of ZCHomes (although a full account would require additional research). The latter two serve to map the overlay of policy framing and associated categories in the policy and evidence processes.

Social constructivism is a phenomenological approach which begins from the assumption that existing arrangements are the product of past negotiations between people with different knowledge, interests and associated understandings (Berger & Luckmann, 1966). In the literature on policy framing, this fundamental premise leads to a view of policy frames as the product of ongoing negotiations between actors with different interests. Moreover, it assumes that policy actors' understandings change as a result of engagement with one another. This position calls for a study of the way in which aims and objectives develop over the life of a policy (points one and two above) and the negotiations which produce those changes. Recently, research into the policy process has underlined the

role of venues in providing, or precluding, non-traditional actors access to the policy process (e.g. Kaunert & Léonard, 2012). As the discussion which follows indicates, the creation of the Zero Carbon Hub involved a displacement of the policy process into a new type of venue, thus suggesting the relevance of this analytic concept.

The sociology of classification adds to this approach a particular interest in instruments and the classifications embedded within them. A central premise of this paper is that evidence producing tools, such as consultations and RIAs, play an important role in the introduction and legitimation of the parameters (classifications) which frame policy problems. Viewed from this perspective, policy tools provide a novel and potentially valuable way to study of policy formulation in particular and governance structures more generally (Hood & Margetts, 2007).

The decision to focus on the development and circulation of formal classifications supports the use of documentary analysis. The approach is widely accepted in policy research (see, for example, Harrington & Morgenstern, 2004; Radaelli, 2005); the key feature is the use of publicly available documents as *primary sources* to reconstruct social processes. In the course of the analysis documents (like other primary sources such as interview transcriptions or written observations) are subject to critical analysis and transformed into processed data. Within organization studies, research which relies on publicly available documents to analyse a particular event is sometimes referred to as 'organizational post mortem' research (Bryman & Bell, 2003; Orton, 1997).

While documents are often combined with other types of data, they can also be used on their own. This use is particularly appropriate in historical research and in studies which focus on public and thus visible processes and outcomes. In the case of the UK policy

for ZCHomes, this approach is appropriate for two reasons. First, the research aim is to trace the circulation of formal (public) classifications, rather than informal processes or individual level motivations and understandings. Secondly, the policy process is this case is extremely well documented. The ZCHub produced an extensive paper trail of progress reports, consultation documents and associated information.

That said, the method dictates the time frame for the study. As the discussion which follows suggests, this paper focuses on the first two phases of the specification of ZCHomes. This is because the third phase was still ongoing at the time of writing, and as such, not amenable to this type of analysis. While this is a limitation in terms of the story, it does not compromise the (more limited) empirical contribution or the more general reflections on the relation between evidence and policy.

Changes in the policy process were tracked through the analysis of numerous documents issued by relevant policy actors. These included formal reports issued by the Business Innovation and Skills (BIS), Office of the Deputy Prime minster (ODPM), Department for Communities and Local Government (DCLG), Department for Trade and Industry (DTI), Treasury, UK Green Building Council (UKGBC) and the Zero Carbon Hub (ZCHub). Analysis of evidence production focused primarily on consultation documents and the five RIA's produced in the course of the policy process and more general scientific reports which influenced the ongoing definition of zero carbon, most notably the Stern Review (2006) and Calcutt Report (2007). While a study of the various meanings which different actors ascribed to these representations would help to explain the content and outcome of specific negotiations, this was not the aim of the paper. In total 87 documents

were collected and analysed. The full list of these 87 documents can be found in an

Appendix located in a supplementary online file [production editor will provide URL here].

DEFINING ZERO CARBON HOMES

The story of policy formulation for ZCHomes is complex. The discussion which follows

presents it from three different perspectives: the policy process, problem definition and

RIAs. The first two use a focus on framing and classifications to explore policy design of the

ZCHome. The account focuses on the period 2006-2012. During this period a number of key

parameters were fixed; at the point of writing, only the issue of how to offset any difference

between the carbon emissions associated with the physical building and the target

(currently referred to as 'allowable solutions') remains undefined. The third discussion

focuses on the role of RIAs in the specification of UK policy for zero carbon homes. RIA's are

the EU and UK government's preferred instrument for bringing evidence to bear on policy

design and thus of special interest for this issue. An examination of their role in the case of

ZCHomes highlights the role of RIAs not in weighing options (as it usually thought) but in

authorizing particular categories in the ongoing specification of ZCHomes as a measurable

target.

Policy Process: Part 1

Designing a policy for ZCHomes involved a variety of actors, venues and events. It

also involved a number of different types of evidence production, including external reports

(which were not commissioned for the purposes of this specific policy), commissioned

reports, Regulatory Impact Assessments, Consultation documents and building level energy

modelling. Figure 1 provides a timeline with these events.

<Insert Figure 1 here>

Before providing an overview of this complex process, it is helpful to introduce the 'standard' policy design process. Two policies leading up to design of a policy for ZCHomes serve both to exemplify standard practice and to introduce the main types of policy instruments currently in use. These include the 2006 revisions to the energy section of Part L of the Building Regulations and the introduction of the Code for Sustainable Homes (CfSH) in 2006.

In both cases, policy design was marked by the announcement of an upcoming change (in the case of Part L) or new policy (in the case of the CfSH) by the Office of the Deputy Prime Minister (ODPM, later replaced by the Department for Communities and Local Government (DCLG)). The ODPM then commissioned reports and RIAs from in-house expert advisory bodies. These provided the basis for public consultation processes which ran for roughly three months. During this period members of the public and professional organizations of all kinds were invited to send in written responses to the questions posed in the consultation document. The ODPM also created a number of industry advisory groups to weigh in on the consultation document. Shortly after the close of the consultation period, the government published its responses to the consultation and a full RIA. Roughly one month later a policy statement was issued. As this account suggests, policy design was largely an in-house process and was structured around the collection of evidence, followed by an executive decision. External groups, whether external organizations, advisory bodies or people involved in consultation exercises, provided 'evidence' but were not privy to the decision making process.

Policy design for ZCHomes began with a similar, albeit more drawn out process. The problem entered the policy agenda in late 2006 as part of the government's response to the

Stern Review on the Economics of Climate Change (2006). One of the impacts of the review

was to convince the government (and others) that it was far less costly to act on climate

change than to do nothing. Less than a month later, Gordon Brown (in his role as Chancellor

of the Exchequer) used his pre-budget speech to announce that until 2012 all new zero-

carbon homes built and sold for under £500,000 would be exempt from stamp duty. He

also announced that within ten years, all new homes will be "zero carbon". While most

commentators focused on the promised relief from stamp duty, a few noted the

introduction of a new concept: "zero carbon home". Shortly thereafter, the Communities

Minister, Ruth Kelly, announced a package of green measures including a progressive

tightening of Building Regulations to ensure that all new homes would be zero carbon by

2016. The target anticipated and surpassed the 2010 revision of the EU Directive which

called for "nearly zero energy homes" by 2021; it also replaced the EU focus on energy with

a UK focus on carbon.

As with the revisions to Part L and the CfSH, policy design began with the

commissioning of expert reports, RIAs on the timetable for moving both Part L and the Code

to Zero Carbon in 2016 and a consultation entitled: *Building a Greener Future: Towards Zero*

Carbon (DCLG, 2006). This was followed by a full (revised) RIA (DCLG, 2007b) and a policy

statement(TSO, 2008). The DCLG statement announced that from 2016 all new homes

would be zero carbon and called for a managed progression to that goal. As the

consultation indicated:

> *"we need to set a target now for moving to zero carbon housing within 10 years*. We
> would propose to achieve this in three steps: moving first, in 2010 to a 25%
> improvement in the energy/carbon performance set in building regulations; then
> second, in 2013, to a 44% improvement; then, finally, in 2016, to zero carbon. Zero
> carbon means that, over a year, the net carbon emissions from energy use in the
> home would be zero."

As this quote indicates, targets for the achievement of ZCHomes were progressive and directly linked to the 2006 Part L of the Building Regulations, which had just been introduced.

This was followed almost immediately by another cycle of policy design around the CfSH. The consultation was entitled: *The Future of the Code for Sustainable Homes - Making a rating mandatory* (2007c). The aim was to revise the Code to support the transition to 'zero carbon homes' in 2016. This correspondence was clearly illustrated in Table 1, included in the consultation document.

<Insert Table 1 here>

In terms of this story it is important to note first, that until this point the policy formulation process remained unchanged and secondly, that code levels were all expressed in terms of emission reductions relative to the 2006 Building Regulations, except for code level 6 or zero carbon which had yet to be technically defined. Two issues which were to prove contentious in the future included the inclusion of unregulated energy (i.e. energy consumed by occupants through cooking, washing and electronic appliances) in the specification of carbon/energy levels and the restriction of allowable solutions to renewable energy sources that were physically connected to the unit via 'private wire'.

Policy Process: Part 2

In 2008, a new actor entered the scene and the standard practice for evidence based policy was disrupted. The rupture in the policy process began with an independent review of the house building industry and its ability to deliver low/zero carbon homes. The *Calcutt Review* was published in November 2007. In its chapter on zero carbon, Calcutt

argued that the scale and pace of the zero carbon policy exceeded "anything that has been

achieved, or even attempted, in Europe or (so far as we are aware) anywhere in the world"

(Calcutt, 2007, p.89). While it did not explicitly say so, the cost benefit analysis contained in

the report directly challenged the one produced for the DCLG consultation. Nor should this

have been surprising given the DCLG's own acknowledgement that the consultation process

"showed that there is currently insufficient information available to establish whether the

cost benefit analysis carried out is reasonable" (DCLG, 2007a, p.64).

To help the industry meet the challenge of zero carbon, *The Calcutt Review* called

for the creation of a "delivery unit" located outside of government to oversee

implementation of the government's zero carbon homes policy (Calcutt, 2007, p.98). This

suggestion led to the creation of a new policy venue: the Zero Carbon Hub. While it was

ostensibly established to support policy delivery, the under-specification of the policy goal

and extreme uncertainty facing the industry involved it in policy design, with consequences

for both the policy and the policy process.

The ZCHub brought together representatives from government, industry and civil

society in an extra-governmental body. Organisations with representatives included:

campaigning groups such as the World Wildlife Fund and UKGBC, independent professional

groups, such as RIBA, LGA, Building Control and Planners, academics, Green Building

Groups, such as AECB (Association for Environment Conscious Building), Good Homes

Alliance and the PassivHaus Trust and industry representatives from a variety of different

roles, including house builders, product manufacturers and consultants. In addition, the

ZCHub engaged with a wide range of professional and trade bodies such as the British

Electro-technical and Allied Manufacturers Association (BEAMA), the House Builders

Federation (HBF), Energy Industries Council, Building Controls Alliance (BCA) and Federation of Master Builders (FMB). Finally, the ZCHub had direct government involvement. Agenda items were informed by questions from relevant government departments and most meetings were attended by one or more representatives from a relevant ministry.

The work of the ZCHub was documented in a succession of progress reports, consultations and reports, informed by extensive building modelling to support realistic policy recommendations and technical advice. As such it acted as a parallel policy body, with its own in-house research capability, but without the authority to issue policy decisions. Between 2008 and 2012, the ZCHub successfully reframed the definition of zero carbon. It did so by shifting the task from a single problem or target to a three part problem (represented by a triangle) and by superimposing additional parameters on each part to produce a set of commercially and technically viable targets. The result is that whereas other European countries classifies energy targets according to national or household interests (such as climatic region), the UK classifies them by an industry-governed logic of house types.

The discussion which follows explores the story of this triangular representation (hitherto referred to as 'the triangle'), the overlay of classifications which constitute it and the inclusions, exclusions and path dependencies which it introduced. A central argument in the paper involves the way in which the production of evidence actively affirmed and institutionalized those classifications, thereby contributing the the very definition of the problem they were supposed to assess.

Problem definition: classifying zero carbon

The first hint of a move towards a three (or at times four) part classification of

ZCHomes can be found in the Calcutt Review. As the authors noted:

> Our view is that the best approach is to require the highest practicable standards of energy efficiency as a first, not a final, recourse. Ideally, remote generation should be taken into account only for discretionary energy uses or on sites where distributed energy generation is, for local or environmental reasons, not feasible.

(Calcutt, 2007, p.93)

The point was picked up by the UKGBC in their report for the 2016 Task Force, *The Definition of Zero Carbon* (2008). Over the next year the initial distinction between energy efficiency, on-site and off-site mitigation were gradually formalized into a triangular representation. The triangle first appeared in the DCLG's consultation document *Definition of zero carbon homes and non-domestic buildings* in December 2008 as a proposed hierarchy for implementing ZCHomes (Figure 2). It divided the problem into four parts, including:

• strict energy efficiency parameters – building design and appliances

• meeting at least a minimum level of carbon mitigation onsite or near-site

• demonstrably additional offsite low and zero carbon energy solutions

• contributions (if needed for offsetting) to a Community Energy Fund, whose proceeds would be used to fund investment in additional low and zero carbon energy. (DCLG, 2008)

One point which was to prove controversial was the inclusion of unregulated energy in the definition of energy efficiency (as indicated by the inclusion of appliances). A second point of future contention involved the target for carbon compliance. Carbon compliance in this document was defined in terms of a reduction of carbon emissions relative to Part L of the 2006 Building Regulations. This was consistent with original government guidelines, but frustrating for the industry, especially after the introduction of revisions to Part L in 2010.

In the hands of the ZCHub, the triangle became the basis for a three stages strategy both for the definition of ZCHomes (policy design) and for their physical design (implementation). In terms of policy design, the Hub called for a progressive definition of zero carbon, starting with energy efficiency and culminating with off-site mitigation. This strategy had two advantages: it allowed policy makers and the ZCHub time to provide more solid evidence based data and it began with those areas and problems which house builders already understood, namely the selection of building materials and systems.

Problem definition: the bottom tier

Starting with bottom tier, the ZCHub's contribution is nicely summarized in their decision to change the name of the category from 'energy efficiency' to' fabric energy efficiency'. This move served to shift the focus from national energy targets to building level challenges. In November 2009 the Zero Carbon Hub published a second report with clear, concrete recommendations for a Fabric Energy Efficiency Standard (FEES)(2009b). A key issue for the Hub was the introduction of different targets for different building types. More specifically, they called for different thresholds for detached homes, semi-detached homes and apartment buildings. They also asked for a change in metric, arguing that the expression of targets as a % of reduction relative to 2006 regulations was confusing. The report recommended that the minimum FEES should be set at: 39 kWh/m^2/yr for apartment blocks and mid terrace houses and at 46 kWh/m^2/yr for semi detached, end of terrace and detached houses. The rates were justified as "challenging but realistic" (ZCH, 2009a, p.10) .

The ZCH submitted their report on 10 November 2010 to the DCLG; two weeks later the Minister of Housing announced a minimum standard for the energy efficiency of 'zero carbon homes' based on the ZCH's FEES recommendations. These were then included in the

DCLG consultation on revisions to the CfSH and in July the Minister announced that the FEES would be incorporated into the 2013 Part L of the Building Regulations. This decision marked a policy success for the ZCHub and the industry; it also institutionalized both the triangle as the accepted approach to the definition and implementation of zero carbon and the classification of carbon reduction targets by building type.

Problem definition: the middle tier

With the definition of fabric energy efficiency in place, the ZCHub moved onto the middle tier of the triangle. Once again, they changed the name to better reflect their approach. The middle tier was renamed 'low and zero carbon solutions' and used to refer to carbon reduction associated with renewable technologies. The term 'carbon compliance' was redefined as the carbon reduction (or rather performance level) to be achieved through the bottom two tiers of the triangle (building fabric AND specified renewable technologies) (Figure 2).

A key issue for the ZCHub was the government's target of 100% reduction through carbon compliance. As the Hub pointed out to its members, this target effectively called for 150% reduction in carbon emissions relative to 2006 standards (owing to the inclusion of unregulated carbon, which was not addressed by Part L) - a level which would require dramatic changes to building practices and business models.

In July 2009 the DCLG conceded the point and issued a policy document identifying 70% as its preferred option (Healy, 2009). While the number may seem precise to some, it was not an example of evidence based policy. Instead, the target would seem to have been chosen for being somewhere between the 44% target for 2013 (relative to the 2016 baseline) and zero (an absolute target which was not yet defined but which everyone

acknowledged could not be completely covered by the building (carbon compliance) alone.

Far from resolving definitional problems, the specification of 70% only served to shift the

problem of policy definition from a definition of the concept of 'zero carbon homes' to the

proportion for carbon compliance.

<insert Figure 2 around here>

In February 2011 the ZCH published an interim report, *Carbon Compliance - Setting*

an appropriate limit for zero carbon homes (2011b)*,* laying out its recommendations for the

middle tier of the triangle. The report rested on: "an extensive exercise in modeling and

reality checking which indicates the limits of what is generally feasible using today's

knowledge of design and technology"(ZCH, 2011b, p.1). As the following quote indicates,

the report criticized the government's target of 70% and offered a more industry - friendly

series of targets adjusted for housing types.

> On the basis of the technical evidence, the Task Group concluded that the currently
> proposed 70% improvement over 2006 is not deliverable as a national minimum
> standard for all dwellings. It would significantly constrain the range of house types
> (and designs) which could be built and the locations where they could be built. In
> particular, it would inhibit the building of apartments.

(ZCH, 2010, p.8)

Instead, the report recommended a range of targets for the 'built performance' emissions

from new homes, by type. These included:

- 10 kg CO_2e/m^2/year for detached houses 2, 3

- 11 kg CO_2e/m^2/year for other houses (semi-detached, terraced etc)

- 14 kg CO_2e/m^2/year for low rise apartment blocks (ZCH, 2010, p.8).

The ZCH metrics differed from the DCLG ones in a number of ways. First, they

substituted the DCLG's reliance on performance as designed with performance as built.

Secondly they replaced percentage improvement over 2006 baseline with absolute limits on carbon emissions, expressed in $CO_2e/m^2/year$. For policy makers confused by this shift in metric and as a point of comparison, the report provided approximate equivalents in a footnote. It noted that, " in addition to any improvement achieved by moving from designed to built performance, the % improvements on the 2006 standard would be approximately: 60% for detached houses 56% for other houses 44% for low rise apartment blocks (ZCH, 2010, p.11). As the reader will note, all three targets are below the government's proposed threshold of 70%.

Moreover, an examination of the modeling used to support the thresholds suggests that they were partly linked to assumptions about the technology mix. Officially, the ZCHub's call for variations in the carbon emissions target by house type was presented as neutral with regard to the choice of technology. In practice, the distinction between terraced and non-terraced homes and apartment buildings suggests that computer modelling was based on the use of photovoltaic (PV) panel to roof area ratios to assess the feasibility of different carbon compliance thresholds (Lees & Sexton, 2013). In contrast to the situation with FEES, where the government adopted the ZCHub's recommendations almost immediately and without amendment, in the case of carbon compliance things moved more slowly. This can partly be ascribed to the change of government in 2010 and the new Treasurer Chancellor of the Exchequer George Osborne's concern that the aim of 'zero carbon' went too far (Gardiner, 2013; Nichols, 2011; Webb & Harvey, 2011). However, in May 2011, the DCLG published an Impact Statement on zero carbon homes which endorsed the ZCH's recommendations for carbon compliance (DCLG, 2011). In response,

the World Wildlife Foundation resigned from the government's 2016 Task Force on the grounds that it was not longer committed to its own target of zero carbon homes by 2016.

While the Government would seem to have accepted the ZCHub's recommendations, they were slow to implement them. In 2013 the Government announced the dissolution of the CfSH. The Zero Carbon Homes policy, however, has survived and negotiations are ongoing over the definition of 'allowable solutions', the stickiest and most problematic of the three tiers (see below). In a significant victory for the Zero Carbon Hub, the Queen's speech in 2011 announced the Government's intention to restrict zero carbon to regulated energy.

As the discussion above indicates, the definition of zero carbon homes was clearly shaped by extensive consultation processes, building level energy modelling exercises and expert reports both commissioned and external. A comparison of these different documents points to the changing contours of the problem as different actors, and in particular, the ZCHub, structured the problem through the overlay of multiple classifications. These include the initial classification of zero carbon into three (or four) parts, the classification of targets for each part by building type and the distinction between regulated and unregulated energy. Within each of these, actors used evidence to develop, assign and defend different numerical values for these different parameters. Strangely missing from the story thus far are the multiple RIA's produced in support of every consultation exercise and policy decision. The discussion turns to a brief investigation of the relevance of RIAs and an update on discussions surrounding the specification of allowable solutions, before using this case to reflect on the relation of evidence and policy

Regulatory Impact Assessments.

Regulatory Impact Assessments are widely used appraisal instruments in Europe and Northern America. Amongst EU countries, Britain has gone the furthest in the production of RIAs (Radaelli, 2009). RIA is a microeconomic instrument which serves macroeconomic purposes: it multiplies the costs and benefits experienced by an individual firm by the total population of firms. The aim of an RIA is to calculate and compare the cost and benefit of the proposed legislation on affected stakeholders. This is presented in the form of a restricted number of options (often three) with the intention of providing policy makers with the evidence needed to select between them.

Far from a recent development, the use of such tools has a long history: since 1966 UK government departments have been required by law to conduct some form of cost benefit assessments (CBA) on all proposed legislation affecting business or the non-profit sector (Radaelli, 2009). In addition, government departments are required to publish RIAs. In principle, departments are also supposed to provide the public with information on how specific calculations are produced; in practice, the complexity and length of many of the documents (often exceeding 100 pages) leaves them less than transparent. While the introduction of summary sheets has helped address this problem, the assumptions built into the quantification of impacts are generally hidden from immediate view, especially when modelling techniques are used.

For the producers of RIAs, the complexity and uncertainty of policy problems pose a central challenge, calling into question the certainty of seemingly precise quantitative evidence. One source of complexity stems from the multiplicity of groups whose costs and benefits are assessed. RIA's produce data at a number of different levels of aggregation;

each of which reflects different actors and interests. In the case of ZCHomes these included:

owners, occupiers, house builders and organizations involved in carbon trading. A second

source of complexity derives from the multiple time scales across which future costs and

benefits are projected. The time frame of RIAs often spans decades, depending on the

expected effect of the policy or project and the level of discounting applied to its related

costs and benefits. This matters because future benefits and cost are weighted less than

near-present benefits and costs. In the case of ZCHomes, these varied from 2050 to 2030

and 2016 – all key dates in the government's overall strategy for addressing climate change.

This time frame contrasts sharply with the Zero Carbon Hub's exclusive focus on delivering

Zero Carbon Homes by 2016.

A key consequence of this complexity is the high level of uncertainty surrounding

the evidential base; RIAs by their nature are replete with assumptions concerning how

affected stakeholders respond to changes in cost curves, learning costs for new

technologies, infrastructures of supply and just about everything else. As such they offer a

particular type of evidence, based in applied science or expertise of one kind or another but

informed by future imaginings.

With these observations in mind, it is interesting to explore the dynamic relation

between the changing framing of ZCHomes in the policy process and in the government's

preferred evidence base, the RIAs. The research for this paper compared the set of five RIAs

produced in the course of this process. The focus of the analysis was on the parameters

used to define, measure and cost ZCHomes.

A first observation is that the way that the RIAs measure the societal cost of zero

carbon at the national level is fairly consistent across the five documents; however the level

of disaggregation presented in each document varies considerably. Some provide little to

no evidence for the predicted impact on occupants or homebuilders; others go into great

detail. This is accompanied by quite significant oscillations in the calculated additional cost

of a ZCHome. The 2009 document calculates the overall additional cost per dwelling to

meet the zero carbon homes target at £7-19,000; this is quite a significant band reflecting

the extreme uncertainty surrounding the calculations. The 2011 document sets the overall

additional cost at £3-8000 (see Table 2)

<Insert Table 2 here>

The reasons for the reduction in the overall additional cost per dwelling between

the 2009 and 2011 RIA are multiple. They include: 1. a relaxing in the specification of the

fabric associated with the Hub's campaign to change the definition and targets for energy

efficiency (the bottom tier of the triangle); 2. changes in the calculation of electricity carbon

factors and biomass prices between 2009 and 2011, leading to higher costs associated with

the status quo (e.g. reliance on grid electricity) and higher benefits of switching to low

carbon solutions; 3. a shift to a much more optimistic CBA model in 2011, as evidenced by

an improvement of about £1.8 bn. for the same electricity carbon factors and biomass

prices; 4. a change in the threshold for carbon compliance (the top of the middle tier of the

triangle) from its proposed 70% relative to the 2007 Part L regulations (or 6 kg

$CO2/m^2$/year) to a range of thresholds by type of housing unit, set at 14 for a flat, 11 for

attached and 10 for detached properties; and 5. the exclusion of unregulated carbon from

the calculation, as announced in the Queen's speech in 2011 and incorporated into the

budget.

Turning to more detailed comparisons in the calculation of costs and benefits at the level of single housing units, the much greater variation in the costs in 2009 relative to 2011 also reflect a change in the source of evidence. In 2009, the DCLG relied on individual consultants from a number of large engineering consultancies to provide them with information on the relevant parameters of a unit house and its carbon emissions. Consultancies varied in how they defined the relevant parameters and in the values supplied. To give but one example, consultancies differed in the assumed averaged number of m^2 in a standard flat. This mattered for the RIA authors because an extra 2 m^2 of floor space leads to an extra 2 m^2 of carbon generation. This difference, multiplied by thirty years, multiplied by the estimated number of flats in the UK can be quite significant.

Returning to the question of the relation between RIA evidence and the policy process, the comments above attest to the very strong impact of the shifting configuration of actors and venues associated with policy design on the content of government produced RIAs. In 2011 the DCLG would seem to have adopted the Zero Carbon Hubs specifications, with around 80% of the models referenced coming from them. This influence is equally evident in the framing of options. The 2011 RIA presented three options, one of which was based directly on the ZCHub's recommendations and was labelled as the governments preferred option.

If one now asks about the impact of the RIAs on policy design, the answer is more difficult to establish. This is in part due to the complexity (discussed above) and in part due to the mutual constitution of the ZCHub's evidence and that contained in the RIA. The most judicious answer is that it is the wrong question. Scholars of RIAs have spent much time seeking to distinguish between different uses of RIAs, including portraying policy-making as

rational, power, management and creating images of accountability (Radaelli, 2010). Most

studies find that RIAs are rarely consulted in policy making. However, this observation

overlooks the extent to which they serve to affirm other types of evidence produced in the

policy process. In the case of the ZCHub, this would certainly seem to be the case. When it

came to decisions about what should happen in 2016, RIAs would seem to have played an

important role in authorizing evidence and thereby recommendations coming from the Zero

Carbon Hub.

Problem definition: the top tier

With the bottom and middle tiers of the triangle specified, the ZCHub began to

apply a now familiar approach to the final top tier of the triangle, labelled 'allowable

solutions'. While this development is outside of the formal scope of this paper – in large

part because was not yet resolved at the time of writing - a few comments serve to indicate

the classificatory and definitional issues involved. As with the lower two tiers, the policy

formulation process has been marked by the ongoing production of reports (ZCH, 2011a,

2012, 2013) official consultation documents (DCLG, 2014), RIAs (DCLG, 2013) ,relatively

transparent public debates organized by the ZCHub and less visible discussions behind

closed doors.

Of all the tiers, the one for allowable solutions is the most novel. The first two tiers

involved efforts to reduce the demand for energy through changes to the physical building

and the recovery of energy using low and zero carbon technologies. As a problem in policy

formulation, the specification of these tiers involved identifying the technical limitations

(such as available roof area) and setting an appropriate minimum target that was technically

and commercially achievable on the dwelling. Both, it should be noted, are familiar types of

problem which the construction industry knows how to address. Thus while the range of

possible categories and the level of targets were novel and open, the types of consideration

deemed relevant were familiar. In contrast, when it comes to allowable solutions, both the

definition of the problem and the range of solutions involve a break with existing ways of

thinking.

At the core of the concept is the idea that, through allowable solutions, house

builders will be required to pay for the emissions that they were unable to reduce or

mitigate through the fabric and technologies. The concept raises many questions, including:

"How much to pay (i.e. what should the price of carbon be)?", "Who to pay (i.e. local

government, national government, private schemes)?","For what (connected/unconnected,

abatement projects)?" and finally, "What counts as an allowable solution?" While no final

decisions have yet been made, a number of categories have begun to emerge. These

include: a distinction in the price of carbon between market based, fixed, capped and

minimum; solutions which are connected vs. non-connected to the physical building; and

solutions which are prescribed vs those which are not. Other outstanding decisions include

things like: Whether a third party should administer the fund and if so, should it be Local

Authorities, National Government or a private organization? and distinctions surrounding

the use of money generated (does it have to create the same amount of carbon abatement

as that needed to reach the mythical 'zero' target on site or can it be fueled into a general

pot of money)?

DISCUSSION

The analysis above began with two empirical questions and two theoretical

approaches. The empirical questions concerned the shifting definitions of ZCHomes over

the course of the policy process and the role of evidence. Since 2006, all three terms in the

concept have undergone extensive redefinition. The term 'zero' has moved from a vague

aspiration to a % reduction in carbon emissions relative to Part L of the Building Regulations

to a set of targets expressed in $CO_2e/m^2/year$ which vary by the type of house plus

something called 'allowable solutions.' While the latter have yet to be defined, it has been

decided that they are financial rather than physical solutions which involve some kind of

carbon offset. The term carbon has changed units and then been reduced, to become

regulated carbon dioxide equivalent (CO_2e). Finally, the term 'homes' has undergone

numerous re-specifications. It began as a single physical unit, which included the activities

of its occupants and anything physically connected to it. The omission of unregulated

carbon excluded occupants from the concept, while the financial definition of allowable

solutions extended its parameters far beyond the physical building or even the site.

Throughout this process evidence in the form of consultation documents, scientific

and technical reports and RIAs, figured centrally. Far from entering into the story as an

external input, the production of evidence was the primary vehicle by which different actors

developed their ideas and promoted them. The DCLG commissioned reports and produced

RIAs. The ZCHub engaged a wide variety of stakeholders in extensive collective reflection,

learning and negotiation over each parameter.

Theoretically, the discussion demonstrates the contribution of a theory of framing

and sociology of classifications to the study of policy and evidence. The theory of policy

framing draws attention to the shifting definitions of the policy problem, namely ZCHomes,

and the way in which different definitions were developed and promoted by different actors

in the lengthy process of policy design. It also points to the importance of policy venues for

both the policy process and the evidence production process. A key shift in the story came

with the creation of the ZCHub. The displacement of the policy process from a relatively

obscure process within the confines of ministerial departments (albeit with external inputs

from consultations and commissioned reports) to a far more public process had a number of

effects. First, it involved a far broader range of stakeholders in policy formulation; secondly,

it opened to public reflection an otherwise closed process and thirdly, because of this, it

shifted the focus of stakeholder engagement from observations on a set of already defined

options to negotiation of the parameters and values which informed them. The result, in

this instance, was a more "realistic" policy (in the sense of combining substantive

commitments to low energy buildings with sensitivity to current commercial constraints).

Turning to the emerging specification of ZCHomes, the sociology of classifications

focused attention on the content of the different definitions. More specifically it pointed to

the conceptual 'infrastructure' which contributed to the selection of parameters and

assignments of values appearing in the different types of evidence in circulation throughout

the process. A basic premise in the sociology of classification is that once authorized, this

'topography' of classifications effectively include and exclude particular things from the

definition of the problem and set path-dependencies which shape what is imaginable and

actionable in the definition, design and implementation of the policy problem.

In the case of the problem of ZCHomes, a number of categories proved to be critical

in the framing of the problem. These included: the delineation of the problem into three

categories and their representation in a triangle. These included: (fabric) energy efficiency,

carbon compliance and an, as of yet not fully defined, category for 'allowable solutions'.

Once introduced the definitions and boundaries (targets and thresholds) which populated

the triangle structured the policy design process and the focus of negotiations. It also

privileged a fabric first approach to sustainability, which is consistent with both economists'

and the industry's interest in starting with the 'low hanging fruit'.

An examination of those discussions also highlighted the introduction of a number

of overlapping parameters. A key dimension was the variation of targets by type of house

(flats, attached and detached). As indicated above, this dimension is specific to the UK.

While the ZCHub is clear that its recommendations were technology neutral, this dimension

would seem to reflect the industry's current preference for solar. As Lees and Sexton(2013)

have argued, solar is the only technology where the amount of roof space is relevant for the

definition of zero carbon. A second parameter framing the discussion involved the

distinction between regulated and unregulated energy. The restriction of the definition of

"carbon" to the latter restricted the industry's responsibility to aspects of energy use over

which they have some influence; it also significantly watered down the ambitions of the

initial proposal. Finally, the definition of carbon is striking for what was discussed as well as

what was not discussed. Nowhere in the documents is embodied carbon even mentioned.

CONCLUSION

In closing it is helpful to reflect on the contribution of this paper to the themes of

the special issue and on the limitations of the study. The story of ZCHomes as told above

engages with a number of themes in this special issue, albeit from a slightly different angle

than that proposed in the initial call. Relevant issues include: the location of expertise,

linkages between policy formulation and evidence, ownership of data and the implication of

all three issues for transparency. The case suggests the value of extra-governmental

venues, which bring together ministerial representatives with a range of stakeholders from

both industry and civil society. The significance of the ZCHub can be seen in the comparison between the government's usual consultation exercises and the activities of the Hub. Most consultation processes offer extra-governmental bodies and individuals the opportunity to comment on a relatively narrow set of questions, often with a pre-fixed set of options. In contrast, the ZCHub provided (or rather created) an opportunity for multiple stakeholders to weigh in on the *framing* of problem and the parameters informing the policy aims and objectives.

This shift from the use of stakeholder engagement to legitimate an already fixed set of policy options to their involvement in the specification of those options provides a powerful model both for the design and legitimation of new policies. Its distinctiveness lies in the shift in the role of evidence (and associated options) from an external input to an object of negotiation and collective learning. Finally, when it comes to ownership, the example suggests that the crucial issue is not (only): "Who owns the data base", but (also): "Who frames it?" where framing is seen as an ongoing process rather than a one time act. In response to the question: "Can the processes and assumptions underpinning selection of options be made more transparent?" The answer this paper offers is yes, but only if the focus shifts from the selection of options to their formulation

When it comes to RIAs, the case of ZCHomes adds to a growing body of evidence regarding the frequent irrelevance of these documents for actual policy decisions (Hertin, Jordan, et al., 2009; Meuwese, 2008; Torriti & Lofstedt, 2012). Far from suggesting that this type of exercise be eliminated, the analysis highlights the conditions under which RIAs and cost benefit analyses may or may not matter. The closer the parameters framing the policy goals are to those figuring in the RIA, the more likely they are to influence policy decisions.

In the same way that current views of evidence would benefit from recognition of the mutual constitution of policy frames and evidence frames, so too policymakers views of RIAs would benefit from greater awareness of the origin and content of key assumptions.

Finally, it is important to underline the limitations of this study. As indicated above, the paper focuses on one aspect of the evidence-policy relation, namely the circulation of categories across policy and evidence frames. Given the complexity of the case, documentary analysis was limited to the policy for ZCHomes in its narrowest sense. Documents concerning the parallel and intimately related development of Part L of the Building Regulations and the Code for Sustainable Homes (CfSH) were not incorporated into the analysis. This decision, in turn, obscured the relation between policy formulation, evidence and implementation.

The study also focused on the first two tiers of the triangle. Two considerations informed that decision. First, decisions surrounding these tiers were completed at the time of the analysis and thus amenable to documentary analysis. Secondly, both tiers (fabric and renewable technologies) engaged the physical structure of the home and as such, they involved "simpler" problems, at least for construction professionals. The third phase, allowable solutions, involves financial and market mechanisms, with the far greater openness which this implies.

A third issue concerns the specificity of this case. While the case of zero carbon homes may be unusual in the initial under-specification of the policy aim, the reliance on operational definitions to give content to broader policy goals is not. Much of the current agenda for low carbon and sustainable construction involves highly abstract, ill defined goals whose content is specified through the framing of evidence, objectives and even

instruments. In this context, it is worth noting that the national plans sent to the European

Commission by 28 Member States varied substantially reflecting different levels of

development of national policies. The objectives varied based on different definitions of

(near) Zero Carbon. Thus, while the UK efforts have focused on defining Zero Carbon

standards, in the Netherlands the objective consists of "zero energy buildings", in Denmark

and France "positive energy buildings" and in Germany "climate neutral new buildings";

Numerical indicators ranged from 0 kWh/m^2 to 220 kWh/m^2(ECEEE, 2014; Marszal et al.,

2011; Satori, Napolitano, & Voss, 2012).

As for the policy process, the case of ZCHomes (and of the ZCHub) is indeed unique;

but not necessarily irrelevant to reflection on evidence and policy more generally. One of

the unintended consequences of a rupture in the standard policy process was to subject

some of the implicit assumptions in the DCLG's initial framing of the problem and in the RIAs

to to critical scrutiny, thereby making them visible. Far from a posing a problem this would

seem to be a great achievement. In terms of lessons learned, the key point is not that policy

makers need to work harder to produce more objective evidence but rather that they need

to render it more transparent and bring it more visibly and critically into the policy process,

recognizing the power of underlying classifications.

Supplementary files
Further detailed information containing the Appendix mentioned in this article can
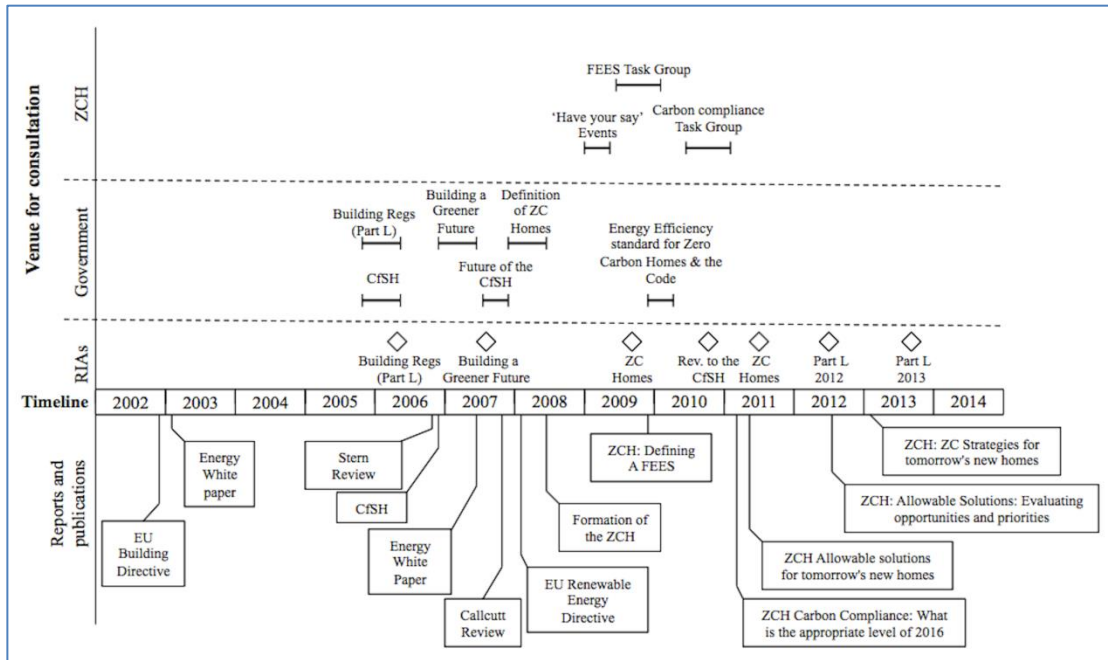be found in the online supplementary file at http://

Figure 1

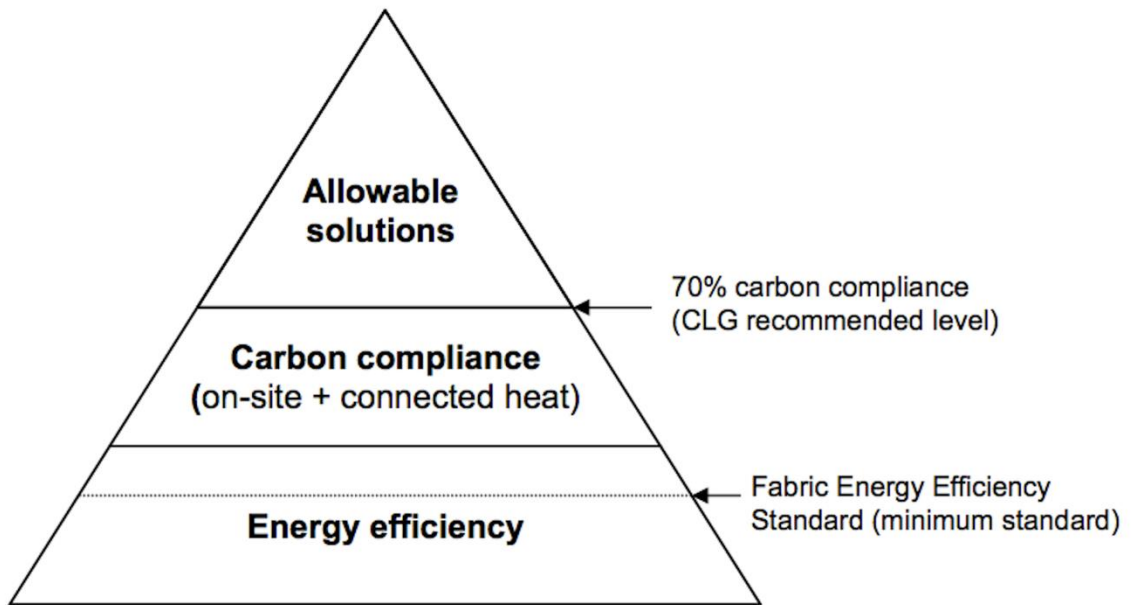**Figure 1** Policy development timeline for the specification of zero carbon homes

Figure 2

Figure 2 The Zero Carbon Hub's representation of zero carbon homes
Source: ZCH (2010)

Table 1

	2010	**2013**	**2016**
Energy/carbon improvement as compared to Part L (Building Regulations 2006)	25%	44%	zero carbon
Equivalent energy/carbon standard in the Code	**Code level 3**	**Code level 4**	**Code level 6**

Table 1: Correspondence between levels in the Code for Sustainable Homes (CfSH) and targets for the progressive move to zero carbon homes

Source: (DCLG, 2007c, p.10)

Table 2

	2006 part L RIA	**2007 Building a Greener Future RIA**	**2009 ZCH RIA**	**2011 ZCH RIA**	**2012 part L amendment RIA**
Overall cost of measure per home (£)	15,000 – 40,000	15,000 – 40,000	7,000 - 19,000	3,000 - 8,000	2,200 - 7,500
Fuel costs (p/Kw)	4.12		7.4		5.23
Social cost of carbon (£ per tonne of carbon dioxide)	70	70	50 (non-traded) + 21 (traded) = 71	50 (non-traded) + 21 (traded) = 71	50 (non-traded) + 21 (traded) = 71
Cost of allowable solutions per home (£)			1,375 – 2,118	1,375 – 2,118	1,375 – 2,118

Table 2 Elements of CBA in RIAs on Zero Carbon Homes and Part L of the Building Regulations

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