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# What buildings policy might look like if we took climate change seriously

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**Abstract.** In 2018, the Intergovernmental Panel on Climate Change released its report on the impacts of global warming of 1.5°C. It called for “rapid, far-reaching and unprecedented changes in all aspects of society” to reduce the risks of increasing climate change. Energy use in buildings is one of the key contributors to greenhouse gas emissions in the UK and EU. Detailed policies to support high standards in new build and acceleration of ambitious retrofit are a necessary part of any serious response to climate change.

This paper begins with a description of key UK policies on energy use in the buildings, and future UK government plans as expressed in the Clean Growth Strategy. It analyses the direction of travel, and looks at the rate of change compared with what will be required to rapidly reduce carbon emissions from the sector. Current buildings policies are insufficient to meet the challenge of climate change. Both positive and negative examples of changes in policy are presented.

A new conceptualization of the contribution of energy demand to delivering net zero goals, developed by CREDS, is introduced. In addition, key characteristics of the buildings sector and its energy use are put forward. Bringing together the role of energy demand, these characteristics of buildings, and the broader literature on buildings and energy policy, we have set out an exploratory set of guidelines for developing policy to reduce carbon emissions from buildings further, faster and more flexibly. These are classified into the guiding principle, approaches to policy creation, expanding the boundaries of policies and focus on quality. These should form the basis for further discussion.

If policy were designed as if we took climate change seriously, according to the guidelines developed, what would this mean for buildings? Fundamentally it would require a momentous change in the culture of construction, so that what is valued moves beyond design, aesthetics and functionality, to include low carbon and highly efficient performance. New targets and approaches to delivering them are required – and this paper contributes to thinking about both.

**Key words:** Climate change; Buildings; Policy

## 1. Introduction

In 2018, the Intergovernmental Panel on Climate Change released its report on the impacts of global warming of 1.5°C [1]. It called for “rapid, far-reaching and unprecedented changes in all aspects of society” to reduce the risks of increasing climate change. While there are many governmental statements in support of taking action on climate change, the evidence is that change is not happening at anything like the rate required. In November, the United Nations Environment Programme released its ‘Emissions



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Gap Report 2018' [2], which concluded that nations need to 'triple efforts to reach the 2C target' (which is less demanding than the 1.5°C target in the IPCC report). The UK is not currently on track to meet intermediate targets leading up to its 2050 target for 80% GHG emissions reductions [3].

In recent months, three civil society movements demanding substantial action in response to the threat of climate change have emerged. The most high-profile is the global 'school strike for climate' movement, inspired by Greta Thunberg who began her weekly strike outside the Swedish parliament in autumn 2018. On 15th February 2019, British school pupils and their supporters joined this growing world-wide movement, with the first UK-wide climate strike. In other European countries, school strikes are a weekly event, attracting thousands, or even tens of thousands. Secondly, the international Extinction Rebellion movement has taken direct action to highlight climate change and species and habitat loss, and calls for radical economic, social and political change. Thirdly, local councils are being urged to declare a 'climate emergency' and as of 27 March 2019, councils representing more than 36 million citizens in Australia, America, Canada, the UK and Switzerland have done so. This includes councils covering 20 million UK citizens [4]. These movements are all demanding immediate, significant and sustained reductions in greenhouse gas emissions.

In 2010, the world's buildings accounted for 32% of global final energy use and 19% of energy-related greenhouse gas (GHG) emissions. Under business-as-usual projections, use of energy in buildings globally could double or even triple by 2050 [5]. Detailed policies to support high standards in new build and acceleration of ambitious retrofit are a necessary part of any serious response to climate change.

The paper is structured as follows. First, we discuss what we mean by taking climate change seriously. This is followed by an overview of UK buildings policy. A new approach to thinking about energy demand is introduced. Principles for guiding development are developed and we illustrate what these could mean at the individual building level. The paper closes with discussion and conclusions.

## **2. Taking climate change seriously**

What do we mean by taking climate change seriously? In a nutshell, it means setting (and achieving) carbon reduction goals for the UK that are consistent with both global justice and limiting temperature rise to 2C or less. To know what this would mean for the buildings sector, this goal then needs to be shared across sectors, acknowledging the constraints on other sectors. Clearly, there are a lot of judgements to be made – each of which could be questioned and debated. The aim of this paper is not to suggest a set of numbers and dates, but to raise key issues and to propose a set of guidelines for developing future policy.

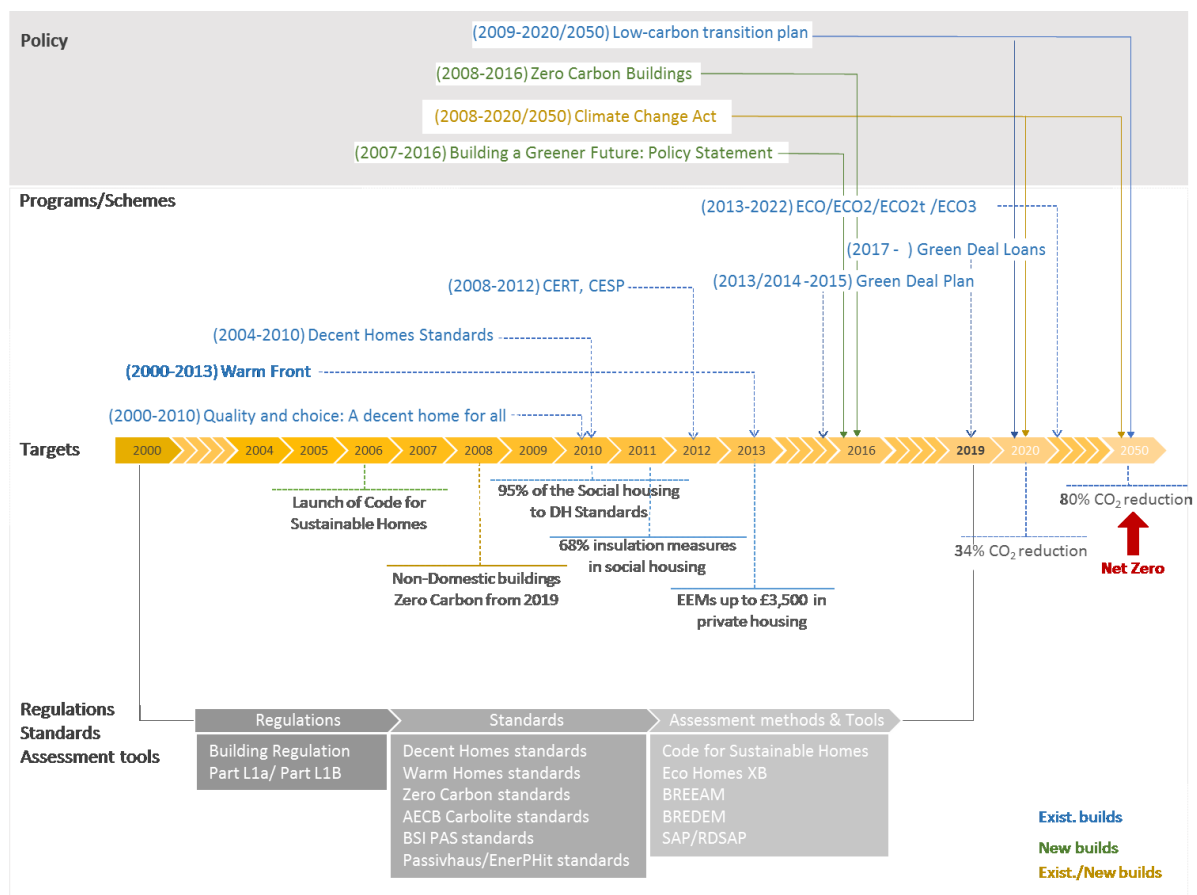
First, a brief review of current targets. The UK Climate Change Act (2008) establishes a long-term target of reducing greenhouse gas (GHG) emissions to 80% below 1990 levels by 2050. To meet this target, via the Committee on Climate Change, the government has established five-yearly carbon budgets which restrict the amount of greenhouse gases UK can legally emit in each five-year period. In October 2017, the government published its Clean Growth Strategy [6]. This set its approach to meeting the 4th (2023–2027) and 5th (2028–2032) carbon budgets and to ensuring that the UK maximizes the economic and environmental benefits of green technology. The IPCC 1.5C report was published after the Clean Growth Strategy, and the government has asked the Climate Change Committee to provide advice on revised long-term targets for greenhouse gas emissions and the UK's transition to a net zero-carbon economy. While the UK is expected to meet targets up to 2023, as mentioned previously, it is not currently on track to meet later carbon budgets.

In May 2019, the Committee on Climate Change recommended that the UK adopt a target of 'net zero' greenhouse gas emissions by 2050. The following month the government announced that the net zero target would be adopted into law. This is a major step forward for the UK and increases the level of ambition considerably. Ambitious targets have also been adopted by elsewhere. Within the EU, for example, France aims to have net zero emissions by 2050, and Germany aims to reduce 2050 emissions

by 95% compared with 1990 levels. However, these targets do not necessarily end the discussion. For the UK, the Centre for Alternative Technology has a 'Zero Carbon Britain' programme suggest net zero greenhouse gas emissions can be achieved for the by 2030. Extinction Rebellion are calling for net zero emissions to be achieve by 2025. So while the UK's net zero target by 2050 currently looks ambitious in relation to past policy, the increasingly worrying scientific news about the impacts of climate change, and growing public appetite for greater change, makes it like to be superseded in future.

In thinking about future targets, a number of issues would need to be considered, at various levels. At the highest level, to set the UK's national target, global justice is important. Within the national envelope, the targets for different sectors need consideration. For buildings, residential and non-residential buildings face different challenges, as do new and existing buildings. Should more devolved targets be set in terms of carbon or energy or both? Should targets apply to buildings, individuals, organisations or all of these? There is evidence that there is still plenty of scope for reducing emissions considerably using conventional energy efficiency measures [7], but we will need to go beyond these. In essence, taking climate change seriously means achieving close to zero net carbon emissions well before 2050 in the buildings sector, with more ambitious interim targets than are currently in place.

### 3. Current policy on buildings



**Figure 1:** Overview of UK energy policy in buildings, 2000 onwards.

Policy on buildings and energy in the UK responds both to EU requirements and to domestic priorities. In this summary we have focused on the policies which are UK level only (so not describing the different

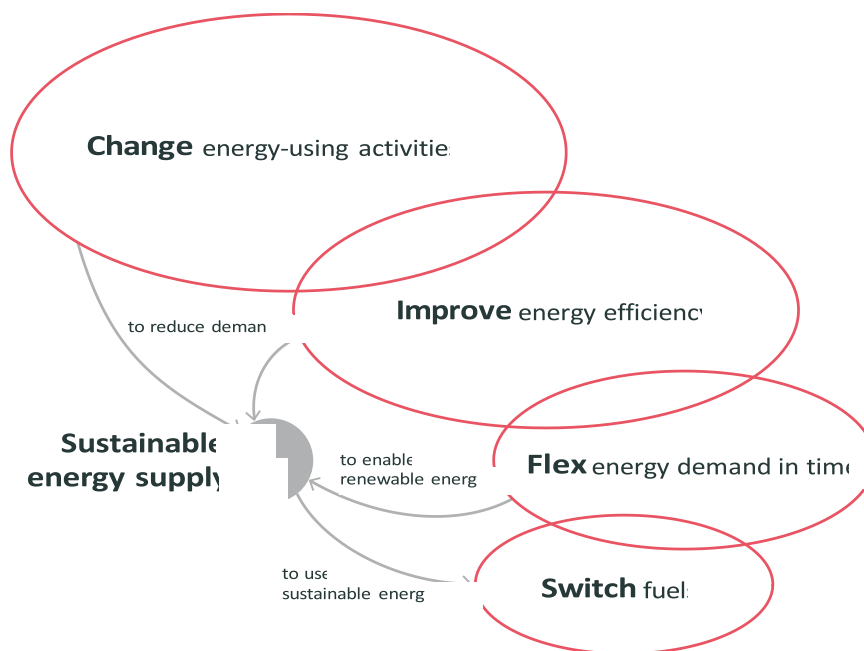
approaches in Scotland and Wales, where devolved powers permit), and have not name-checked the relevant EU directives. Figure 1 sets out key policies from 2000, individual programmes and schemes, targets (up to 2050), regulations, standards and assessment tools. Policies and measures have been separated into those for new buildings, existing buildings and for all buildings. There have been various policy interventions across the period – some more successful than others, a myriad of standards, and the underpinning of Building Regulations, which most powerfully affect new buildings. Several important policies have been removed (e.g. Warm Front, Code for Sustainable Homes, Green Deal Plan) or redesigned to deliver lower energy and carbon savings (e.g. ECO). UK buildings policy at present does not have the policy mix necessary to meet its top level goals [3].

Here we describe briefly how lack of continuity of policy in the new build residential sector has adversely affected carbon emissions, development and delivery of innovative, low-carbon market solutions, and decision-making by local authorities on standards. The Code for Sustainable Homes, introduced in 2006 was to have been the framework leading to a low or zero carbon new building stock, with 2016 as the date by which high standards - ‘Code 6’ - were required. However, the housing standards review in 2015 resulted in scrapping of the zero carbon buildings policy and the mandatory 2016 target. This decision has been widely criticized. At the same time as this national standard was removed, the situation was made more complex for local authorities, in terms of whether their planning powers permitted them to require higher standards for developments. Simultaneously, the Building Act 1984 was changed to allow new optional standards to be introduced and required; while an amendment to the Planning and Energy Act 2008 constrained the ability of local authorities to go beyond the Building Regulations energy efficiency standards for new homes. This ambiguity has led to some authorities requiring higher energy efficiency standards (where particular regulatory tests are met), but others have understood the situation to mean that they cannot go beyond current basic energy efficiency requirements as outlined in Part L1A of the Building Regulations, thus holding back long-term zero carbon goals.

A more positive example of change relates to professional standards, training and quality. In 2016, the Each Home Counts review outlined 27 ground-breaking recommendations to improve the government’s and consumers’ confidence in domestic retrofit [8]. The quality mark for residential retrofit suggested will be delivered via a government-endorsed quality scheme supported by an industry Code of Conduct, a Consumer Charter and a framework of technical standards for retrofit (PAS2035 – to be launched in 2019). This scheme will set the requirements for assessing a building’s existing condition, identifying and evaluating the options of improvement and the risk involved in the design and specification of the energy efficiency measures, and set the monitoring and evaluation requirements and the skills of the actors involved in all stages of a retrofit process.

#### **4. A new approach to energy demand policy – the big picture**

The Centre for Research into Energy Demand Solutions (CREDS) is developing thinking on the place of energy demand in the UK energy transition (to net zero emissions). Demand for energy, in buildings and other sectors, is determined by the energy-using activities undertaken and the efficiency with which these occur. However, in the context of the transition, reducing demand for energy is no longer the only issue. There are at least two other demand-side issues which need to be addressed – demand flexibility and decarbonisation of energy sources used at the point of demand [9]. These multiple aims for demand change in the energy transition – efficiency, reduction, flexibility and a switch to sustainable fuels – cannot effectively be analysed separately. A sustainable, affordable and secure energy system will require all of these elements in combination. Figure 2 sets out a simple representation of how CREDS sees them contributing to energy system transformation.



**Figure 2:** Contributions of the demand side to energy sustainability (source [9]).

The diagram shows what is necessary on the demand side, and the links between that and a sustainable energy supply, to give a (simple) whole systems overview. Changing energy-using activities and improving energy efficiency are critical to ensuring demand is low enough to be met by sustainable fuels. In addition, it is important that demand is flexible in time (the ‘flex’ bubble) ensuring that the sustainable energy supply can meet peak as well as average demand, and at lower cost. Most buildings-related policy has focused on increasing energy efficiency as a means of reducing demand, with much less focus on changing energy-using activities. Delivering changes in energy use could range from overall approaches such as passive design in retrofit (e.g. cooling and heating), to detailed requirements like the provision of outdoor clothes drying facilities in new residential developments. While this diagram is not presented as hierarchical, as all steps are necessary, the ‘bubble’ sizes indicate something about the relative importance of different elements of demand side action.

## 5. Developing principles to guide buildings and energy policy

When thinking about how to create policy for the buildings sector, it is important to take into account the nature of buildings and the energy services they provide. There are two critical characteristics of buildings in this context:

- Buildings are unique and change/ age differently (even factory-manufactured buildings);
- Energy use from buildings is a result of interactions between the buildings, the external environment, their energy-using equipment and controls, and their users, to achieve or maintain their comfort preferences, safety and security.

These characteristics matter for policy because they tell us important things about what technologies, control systems and organisation- and people-focused interventions are likely to be most effective. The first characteristic suggests that ‘one size does not fit all’ – certainly not for more ambitious, deep renovation strategies. So, for example, while the idea of off-site manufacturing of insulation panels may be helpful in some situations, it cannot be a universal answer. The second characteristic reflects evidence that energy used in very similar homes and offices can vary considerably, with evidence that this can be due to a myriad of small differences in hours of occupation, habits and technologies [10]. This characteristic also points perhaps to the limitations of building energy modelling (for some purposes),

and the distinction between performance of buildings according to standard assumptions, and their real-life performance.

Bringing together the CREDS approach to energy demand change, these characteristics of buildings, and the broader literature on buildings and energy policy, we have set out an exploratory set of guidelines for developing policy to reduce carbon emissions from buildings further, faster and more flexibly. These are classified into the guiding principle, approaches to policy creation, expanding the boundaries of policies and focus on quality. The guidelines chosen are very briefly justified.

**Table 1:** Exploratory set of guidelines for developing building and energy policy.

Theme	Key guidelines
Guiding principle	<b>Contribute to the UK's net-zero goals</b> taking account of all aspects of energy demand change (Figure 2)
Approaches to policy creation	<p><b>Use a policy mix:</b> A complex set of problems requires a complex response. Policy is needed at different scales, focused on different actors, technologies, decisions etc. [11]. It also needs to go beyond energy efficiency.</p> <p><b>Allow flexibility</b> - this is critical given the variability of buildings. We need flexible/adaptable approaches for some aspects of policy, without compromising overall carbon reduction goals. For example, heritage buildings might not face strict low carbon standards, or deep residential renovation could happen over extended time periods.</p> <p><b>Recognise multiple benefits:</b> Energy saving or shifting energy use in time (flexibility) has multiple benefits – environmental, economic and social. These must be recognised within policy making, at all scales from the single building, to city to national, and multiple actors engaged around their own values.</p> <p><b>Embed policy experimentation and learning:</b> (includes support for new technologies) Learning by doing will be essential, as will being allowed to tell ‘learning stories’ [12]. Establish feedback loops between different scales and levels as a reflexive responsive mechanism to respond to implementation failures avoiding/reducing the design-performance gap.</p>
Expand the boundaries of policy	<p><b>Recognise policy connections.</b> To make effective policy we need to go beyond the boundaries of current policy – to include renewables, flexibility / demand response, planning, heat networks etc. For example, there needs to be legal reform of governance for buildings in multiple ownership, if they are to have energy retrofits [13].</p> <p><b>Adapt to climate change:</b> Buildings need to adapt to existing and expected climate change – particularly higher summer temperatures, more heat waves and extreme weather events. These are likely to affect the health of building occupants and increase the deterioration of buildings.</p> <p><b>Include embodied energy:</b> As the whole economy must decarbonise, the embodied energy in buildings materials, services and equipment (for new build and retrofit) will become more significant.</p>
Focus on quality	<p><b>Improve skills &amp; training.</b> Without a skilled construction sector, with sustainable values, change cannot be delivered. A new standard under development, PAS 2035, should help upskilling by changing the culture of responsibility and trust between multiple actors. For example it embeds the notion that a project doesn't end at the handover stage, but ensures quality of performance continues throughout its lifespan.</p> <p><b>Focus on evaluation &amp; enforcement</b> This is required to close the design-performance gap, to ensure renovation work is done to specification and to improve the policy process. We need feedback loops that reach from middle actors to top level actors (from the designers, builders, suppliers etc to the policy makers).</p>

## 6. What would buildings look like if we took climate change seriously?

If we could design policy as if we took climate change seriously, according to the guidelines above, what would this mean for buildings? Thinking particularly about new buildings, the culture of

construction needs a momentous change in which the prominence of a building will not be limited primarily to the design (aesthetics) and functionality but will put low carbon and highly efficient performance at the top of the hierarchy. This requires a whole cultural transformation, change of the values and principles towards demand reduction not only of the building designers, and other professions in the construction sector and supply chain market, but also of the building users. Also a move beyond linear processes in which the finish line is at the delivery or completion of a building, installation of technology or a system.

It would mean, at single building level, improving a building's energy performance to net zero carbon emissions by including:

- high performance building envelope;
- energy efficient services in heating, cooling/ ventilation and lighting;
- control systems and onsite generation flexible enough to respond to user preferences/lifestyle and changing conditions;
- passive building design or solutions (that minimise or eliminate the need for mechanical heating, cooling and ventilation) as single or complex of buildings;
- flexible design and adaptive solutions to technical, social and climate changes;
- passive/active interaction of the users with the building system (user behaviour and awareness of energy use practices);
- repair and maintenance services that follow a building's ageing and life-span changes, allowing for short term/long term interventions.

## 7. Discussion

In this paper we've started the discussion from setting the broader picture of the role of demand in the energy transition, followed by a set of guidelines that can drive building energy policy design in order to deliver the low carbon transition and zero or low carbon emissions buildings that have the characteristics discussed above.

The challenge of responding to climate change cannot be over-stated for the buildings sector or for society as a whole. While there have been impressive improvements in buildings energy efficiency and a switch towards renewable sources of energy in recent years, there is a huge distance to go and little time in which to do it. The aim of this paper has been to try and link this high-level concern with the more detailed world of energy use in buildings and policy design. The table of guidelines which has been developed is very much open for discussion. It has attempted to compress important insights from across the literature into a rather simple format. Clearly this risks overlooking important linkages between topics, and all sorts of nuances. Hopefully the advantage is that by taking an overview approach, we remember the big picture, and avoid focusing all our attention on policy details, important as these are. The next step is to discuss the contents of this table with colleagues (including at the conference) and discover whether it is thought to be a useful approach, and a basis for building policy in response to climate change.

## 8. Conclusions

The unprecedented challenge of decarbonising energy means that, while we can and should learn from past UK, EU and international policy experience, we are likely to need new approaches to the design, types and mixes of policy, institutions and delivery mechanisms. We will need to re-think governance and expand the ambition and reach of policy. The energy transition will require changes in technologies, practices and choices for every household and business, many of which we do not currently know how to organise technically, cost-effectively or in a socially acceptable way.

This paper has set out key elements of current policy, and shown how these are inadequate to meet the challenges we currently face. It has used the recently developed CREDS energy demand conceptualisation, to re-think how policy is formed, and specifically how it should be formed for



buildings taking into account key characteristics of the buildings sector and its energy use. This has led to development of an exploratory set of guidelines for creating effective buildings policy. These should form the basis for further discussion.

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