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The UK's experience in mitigating climate change: a planned strategy or a learning curve?

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ABSTRACT

Reducing the CO₂ emission by 80% from 1990 level by 2050 is a challenging operation for the UK. This challenge has embarked the whole nation in a national exercise that involves professionals in all sectors, corporations, SMEs, families and individuals. The nation meets every day with new tasks, initiatives and incentives designed to meet that target. The built environment is one aspect of this multi-faceted exercise and within the built environment itself many aspects are being tackled. This paper evaluates the current legislations, initiatives and incentives introduced in the UK to reduce the energy demand in the Built Environment and how they contribute to meeting the UK's international obligation in cutting CO₂ emission.

Incentives such as feeding tariff for renewable energy, Green Deal for upgrading buildings and many other initiatives; have been withdrawn, revised or replaced after their excessive success or unexpected failure. These actions reflect the lack of clear plan and strategy. This paper won't examine the reasons of these success or failures but will use these disruptions as a call for the establishment of serious tools and mechanisms as a platform for discussion in mitigating climate change. Although the theme of this conference is dedicated to developing world, we believe that exchanging our experiences will benefit developing countries in avoiding our mistakes and follow successful steps. There is certainly no benefit in re-experiencing same failures as the world is embarked in the same climate change mitigating exercise.

INTRODUCTION

The climate change is monitored very closely by the IPCC (Intergovernmental Panel on Climate Change), whose main task is to review and assess scientific and socioeconomic data produced globally in order to understand climate change and in particular the effect of human activity on climate change (Ippc.). Although there is evidence of the changes in global climate in the last 10.000 years, IPCC's

reports show a significant rate of increase since 1750. A date that coincides with the industrial revolution (Pearson & Foxon, 2012) which has involved intensive use of fossil fuel to run ambitious industrial ideas and increase productivity (Antràs & Voth, 2003). Since then, an ever increasing large-scale production to satisfy booming economies and people's desire to maintain a comfortable level of living standard has worsened the situation of the planet's climate.

The global warming has entered the public domain after serious research undertaken in the 1950s when scientists began assessing the CO₂ effect on climate change worldwide. The sad news resulted in the whole world engaging in long debates on how best to mitigate climate change. These debates took place between governments as well as nongovernmental organisations and resulted in solutions that were interpreted by each participating country, in different ways. The goal was to reach an optimum level of CO₂ emission in the atmosphere while keeping industrial and socio-economical activities moving forward to meet people's needs and expectations in a sustainable manner (Momtaz, 1996).

The aim of this paper is to present the various initiatives introduced in the UK to mitigate the effects of the built environment on climate change as well as to evaluate their effectiveness. This investigation will show that some of these initiatives are rushed which is evidenced by the fact that many of them were withdrawn or revised shortly after being introduced.

THE UK AND ITS COMMITMENT IN MITIGATING CLIMATE CHANGE

The UK as many nations started organising itself to deal with climate change throughout conventions, agendas, road maps and declarations. The country took swift actions and made significant commitments in response to these climate change (Department of energy and climate change. May 2014).

We have to bear in mind that, despite the CO₂ emission worldwide being multiplied by three since 1990, the UK are still referring to the 1990 levels in their commitment to reduce the CO₂ emission by 80% by 2050. Nonetheless, even such commitments require legal and technical instruments to be honoured.

In the Built Environment, various instruments have been created to reach that goal; these instruments varied from legislations to personal initiatives where the awareness was a major driver in finding alternative solutions to tackle climate change.

THE UK MAJOR ENGAGEMENT ACTIONS IN MITIGATING CLIMATE CHANGE

The UK signed international agreements and reflected on them nationally put in place policies to reduce greenhouse gas emissions relatively early as part of the international efforts to limit global warming and other effects of human induced climate change. It now has a range of measures and targets in place, underpinned by statute, to achieve the reductions and in this regard has been one of the leaders internationally. As stated by the CCCEP (Centre for Climate Change Economics and Policy): "CO₂ emissions are the main focus of climate change mitigation policies in the UK as they account for around 80% of total greenhouse gas emissions".

However whilst the UK may claim, with some legitimacy, to have been at the forefront of measures and policies to tackle climate change it is less clear how effective those measures and policies have been, or indeed what the likelihood is of achieving the ambitious target of an 80% reduction in carbon emissions by 2050.

According to The Energy Saving Trust, in order to 'achieve these goals the UK needs radical change' (Energy saving trust, 2014). A report on the UK's climate change policy, in 2011, by the CCCEP concluded that 'a step-change in the pace of emission reductions is required to put the UK on

the path towards its ambitious 2050 target' (Climate change policy in the United Kingdom, 2014).

Since the UK government passed the Climate Change Act in 2008 to impact positively on climate change, this long term legally binding framework requires the reduction of the UK annual carbon emissions to 154.2 million tonnes of CO₂ by 2050.

To reach such level of CO₂ reduction, the British Governments introduced a number of regulations and incentives at various levels. These regulations were not necessarily based on a quantitative analysis and scheduled intermediate aims based on capabilities to meet the set target. Selected regulations and incentives are shown next and vary between successful unchanged regulations to multi-updated incentives.

UK ACTIONS TOWARDS REDUCING CO₂ IN BUILDINGS AND THEIR REVISIONS

1. The introduction of the Energy Performance of Buildings Directive (EPBD) in 2003 which influenced the construction industry and building renovation. However, this measure can be challenging given that the buildings' actors need to look for different means to reduce the building energy consumption and require the exploration of a huge number of possible combinations of energy-saving measures. (Hamdy, Hasan, & Siren, 2013). A recast took place in 2010 followed in 2013 by a proposal from the Scottish Government to consult on the implementation. A new change took place in 2013 as a result and the green Deal took place (Scottish Government).

The Government introduced SAP (Standard Assessment Procedure), a method which aims to calculate and assess the overall energy use of buildings. Although this method of assessment didn't go through revisions and changes, its formulation was not practical for all buildings. This method was criticised at various levels, it still has its importance in energy use assessment of dwelling, but still controversial (Kelly, Crawford-Brown, & Pollitt, 2012). SAP calculation is a requirement to demonstrate compliance with the energy performance requirements of Part L of the Building Regulations, as well as used to demonstrate achievement of the required performance levels for sustainability benchmarks such as the Code for Sustainable Homes.

2. Building Regulations Part L (Conservation of Fuel and Power). Provides guidance on the means to comply with the energy efficiency requirements of the Building Regulations. It deals with a number of areas including insulation requirements, heating and air permeability etc. but also sets out the requirements for SAP calculations and Carbon Emissions Targets for dwellings (Planning portal, 2014). The reinforcement of the existing Building Regulation in its Part L dedicated to the energy performance. This continuously updated regulation has seen a huge step forward in regards to the minimum energy performance requirement of new buildings and refurbished existing buildings. The requirements, expressed in U-Val, are not generic to the whole building but very specific to the building's components such as the roof, wall, windows and floor.
3. The Building Regulations co-exist with other standards and recommendations that largely relate to best practice (Department for building innovation and skills, 2014), for example BREEAM and the Code for Sustainable Homes. BREEAM is an environmental assessment method and rating system for buildings which, amongst other key areas of environmental impact, addresses energy demand, consumption and CO₂ emissions by promoting designs that minimise demand and consumption in buildings thus reducing carbon emissions. These instruments have been in place early enough to influence the building sector by reaching the whole building sector industry and achieve thereafter part of the goal.

4. The Code for Sustainable Homes is in effect the domestic version of BREEAM and there remains to date a mandatory requirement for new homes to be rated against the Code. However in an effort to reduce 'red tape' in the housing construction industry the government has confirmed, in March 2014, that it will be 'winding down' the Code and consolidating some of its requirements in the Building Regulations (Sustainable construction legislation, regulation and drivers, 2014).
5. The Feed-In-Tariff was announced in 2008 and introduced in 2010 to replace the UK Government grants as the main financial incentive to encourage uptake of renewable electricity generating technologies. Less than a year into the scheme, the new coalition Government announced that support for large-scale photovoltaic installations would be cut. From August 2011 the rate for installations changed. In October 2011 a second review of the Feed in Tariffs for low carbon electricity generation was announced and was supposed to take an effect from 12th December 2011. In its second year, the government announced further cuts to the FIT scheme. On 5th March the tariff was cut done. This cut was originally scheduled for 12th December 2011 but was delayed. The latest cut came into effect on 1st November and this rate was set to remain until 1st February 2013). Another drop in the FIT is to take place in January 2015 to £0.13 that is a 1/3 of its original incentive of £0.43. This can't come from a strategic approach unfortunately.
6. Energy Performance Certificates (EPC) is a Post construction monitoring tool, reporting on energy efficiency of building of small scale. The buildings are then classified into categories from A to G where A indicates the best rating. EPCs are mandatory for the sale and letting of properties but they provide only theoretical ratings on energy performance based on the design and construction in conjunction with assumed patterns of use and occupation. Such theoretical assessment doesn't convey a full understanding of buildings and a more measurable approach are required to really have a clear perception of these buildings. Further collaboration between energy supply companies to provide buildings' energy consumption might give a better understanding on where these building stands in regards to their CO2 emission but not on their heating need therefore separated meter for heating and cooking where possible will narrow the potential misleading analyses given by the EPC.
7. The Display Energy Certificate (DEC) (Display energy certificates, 2014) is more of a permanent document to display. They are far more informative with regards to energy performance as they are based on actual consumption but despite the fact that there is evidence that their use can help achieve substantial reductions in energy use they are currently only a requirement for buildings that are over 500m² and occupied by the public sector (Fuerst & McAllister, 2011). There is more of a psychological influence on occupants to save energy but might not be effective in long term if actions are not taken forward.
8. The compulsory inspection of equipments, such as boilers, to insure their performance. This is an important measure given that 57% of energy use in the UK goes towards space heating. However, the guidelines did not insist on the best performance at this stage but a new future enforcement is due to take effect where buildings will be assessed to that level. As a consequence, many landlords might find themselves not able to rent out their properties if they don't meet certain levels of performance. (Hamilton, Steadman, Bruhns, Summerfield, & Lowe, 2013). This level of performance, although known, is still unclear on how to be reach in efficient way.

9. The Green Deal was included in the Energy Act 2011 and came into force in 2012. In 2014 a second green deal would be launched, as grants rather than the loans which underpinned the original Green Deal scheme.

The initial Green Deal didn't take into account a socio economical and behaviour of home buyers since the deal consisted on a loan to be granted and remain with the property rather than with the initial owner, hence its failure. The Green Deal is a government initiative to try and incentivise building owners and occupiers to invest in improving the energy efficiency of existing properties by offering 'green finance' for the installation of energy efficiency measures. Taken at face value a scheme that offers the chance to fund improvements to the energy efficiency of property with the promise that the savings will outweigh the cost of the finance (the so-called 'Golden Rule') appears attractive and an effective way of targeting a big contributor, housing, of carbon emissions.

The reality has been somewhat different with doubts over value for money (uncompetitive interest rates for the loans offered) as well as little, and often conflicting, evidence to support the government's assertion that the investment is financially worthwhile (for the occupier). Uptake to date has been very low and the initiative is plagued by the perception that neither energy companies nor the government are committed to the scheme.

The Green Deal is an attempt to deal with the retrofit of energy efficiency measures in existing homes which is clearly is a key area to target but its apparent failure suggests the strategy is not working in its current form.

10. The GCB was set up to provide leadership to the sector on reducing carbon emissions and capitalising on low carbon growth opportunities, as well as monitoring the implementation of, actions in the Low Carbon Construction Action Plan. It was announced in February 2014 that the Green Construction Board (GCB) will continue its work on reducing carbon emissions for a further two years. The focus of the GCB over the next two years will be working towards delivering the 'ambition of a 50% reduction of greenhouse gas emissions by 2025'. It will be interesting to see what recommendations are made to achieve the 'ambition target' of 2025 that will act as benchmark for the 2050 commitment.

The above list can be extended to other actions and strategies however the message is conveyed through these actions and showing the country's 'rush' to demonstrate many actions towards 2050 target. Although all actions are positive in their contents, the wider vision doesn't seem to be that positive. The fact that these actions were addressed short after their applications and this reflects a quick response and therefore a close monitoring of the outcomes. Were these actions put in place for just testes? Something we won't know from diferent governements in place since?

BUILT ENVIRONMENT AND CLIMATE CHANGE

The Royal Institute of British Architects (RIBA) describes the UK government's overall strategy as 'encouraging organisations to reduce their emissions and embrace opportunities through setting regulations, establishing market-based mechanisms, providing incentives and ensuring the provision of information, advice and support'. It [the government] hopes that in doing this it will 'help to stimulate development of low carbon solutions and services and promote their uptake within the UK' (Willars, 2014).

The UK Green Building Council quotes: Construction and Sustainable Development report that states that 'energy from fossil fuels consumed in the construction and operation of buildings accounts for approximately half of the UK's emissions of carbon dioxide' and 'housing alone generates 27% of UK emissions, of which 73% is used for space and water heating' (Constructing Excellence, 2008). This

means that space and water heating in UK homes is responsible for nearly 20% of the UK's carbon emissions.

Further evidence is found in the UK Government Department for Business Innovation and Skills 2010 report that estimated the amount of CO₂ emissions that the construction industry can influence. It considered the life cycle of buildings from design, through operation to refurbishment/ demolition. It concluded that the industry could influence almost 47% of all the UK's emissions and in-use building emissions accounted for 80% of this figure (Department for building innovation and skills, 2014). Therefore building emissions in-use alone is estimated to account for over 37% of all of the UK's CO₂ emissions.

It is not disputed that the built environment and the construction industry are major contributors to the UK's carbon emissions and therefore required to play a significant role in actions and strategies to meet the reduction targets. In the UK the means of doing this is largely through the Building Regulations. The Building Regulations are the statutory instruments that are used to try and ensure that legislated policies are acted upon.

The UK has highly ambitious targets for 'zero carbon' standards but it remains unclear as to exactly what the definition of 'zero carbon' is or how it will be reached. The Code was introduced in 2006 to help achieve the pledge that all new homes would be 'zero carbon' from 2016 but its 'winding down' is part of a wider review and plans to 'rationalise all building regulations and national and local housing standards' (UK Green Building Council, 2014). The UK Green Building Council claims that not only was the 2016 Zero Carbon target instrumental in achieving improved environmental standards and innovation in building (UK green building council, new built.2014), but also that the changes now being made will 'almost certainly result in poorer quality homes, built to lower environmental and social standards' (UK green building council-government shake-up of housing regulations likely to cause confusion, affect quality and slow down delivery warns UK-GBC, 2014).

Inevitably, opinions differ on the motivations and likely impact on sustainability of the decision to phase out the Code. The decision is based on a desire to reduce 'red tape', and in the process help to invigorate the housing construction industry. This raises an interesting point that is a basic problem for governments in tackling carbon reductions. One of the biggest reductions in carbon emissions recently followed the 2007 recession and downturn in the economy and conversely a growing economy sees an increase in output and carbon emissions. A challenge for government is to stimulate and grow economies without sacrificing climate change targets. It begs the question of whether governments can be relied upon to balance long term climate change policies over other issues such as economic growth.

One of the key issues of this study is the energy performance gap: that is the difference between the designed performance and the actual in-use performance with regards to energy efficiency and consequently operational carbon emissions. It is interesting to note that the mandatory requirements for assessing energy performance prior to construction are based on theoretical performance and that the reporting on the energy efficiency of the vast majority of buildings once completed and in use is also based on theoretical assumptions rather than actual performance. A 2012 report that analysed actual energy use in commercial properties found 'little or no correlation between EPC ratings and actual energy performance' (Jones Lang Lasalle & Better Buildings Partnership, 2014).

THE ECONOMICAL IMPACT OF MITIGATING CLIMATE CHANGE

The move to the low carbon economy cannot be without an impact as stated by Sir Nicolas Stern, who highlighted, in a world renowned report, the dramatic consequences of not acting and insisting that the economical impact of not acting is worse than acting: "The costs of stabilising the climate are significant but manageable; delay would be dangerous and much more costly." (STERN, 2007). We should emphasise that the economical aspect of mitigating the climate change was of concern at an early

stage of the climate change debate. Although nations have different financial capabilities, they, nonetheless, face the same challenge. Such financial disparities were addressed in later climate change discussions and encouraging solutions were found to make it less challenging for developing countries. This was introduced in the form of CO₂ trading mechanisms involving developed and developing nations as stated by the United Nation Framework Convention on Climate Change (UNFCCC) 2014).

DISCUSSION AND CONCLUSION

The concerns raised in this paper appear to be fairly consistent in saying that:

- ☐ There is a lack of clear understanding of the mechanisms and their capabilities in mitigating climate change in the UK. The withdrawn of certain initiatives based on their excessive success such as FIT was not particularly welcomed.
- ☐ Current legislation and strategies are insufficient, inconsistent and unclear from the operational perspective.
- ☐ The rate of progress needs to change radically if the UK is to have any chance of meeting its legally binding commitments by 2050. Meeting the target in advance is also problematic since this will be achieved against other needed development in the country.

In consideration of current observations and research it seems that some of the key areas of focus in order to achieve the government targets of CO₂ reduction that require further investigation are:

1. Making DEC's mandatory for all buildings so that the actual performance is measured rather than theoretical (predicted). DEC's are also accompanied by an advisory report that identifies measures to improve the buildings' energy rating as currently there is no obligation to act on the advice in the report.
2. Legislation tends to focus primarily on new build properties. The biggest single contributor to carbon emissions from the built environment and construction is operational carbon from residential property (space and water heating) and the vast majority of dwellings (around 80%) that will be in use in 2050 have already been built. Therefore retrofit should be the main focus to reduce in-use operational carbon emissions.
3. The way the building occupiers behave and use their buildings is hugely significant in terms of energy consumption (and therefore carbon emissions), yet existing assessment methods such as SAP ratings and EPC's are not able to account for the complexities and variations that accurately reflect how significant occupant's behaviour is.
4. The government needs to increase its efforts to incentivise people and organisations to want to make their buildings more energy efficient. A small percentage will pursue a low or zero carbon building because of an ideology or ethos but the majority will respond more to legislation and/or financial incentives.
5. The revisions of many initiatives including legislations and incentives the UK saw in the last decade reflects a clear uncertainty in regards to the effectiveness of what is made in place to mitigate climate change.
6. There is still a lack of strategy to quantify and measure the potential outcomes of these initiatives hence their suspension or revision.
7. There is not enough measuring of the actual performance and too great an emphasis is placed on the theoretical or predicted performance based on design assumptions.
8. Not enough is done by the government to make it easy and cost effective for building owners and occupiers to implement energy efficiency measures in existing buildings with an over reliance on 'encouragement' and 'hope' that the market will develop low carbon solutions that are taken up to 'solve' the problem.

It is understandable that a start needed to happen to mitigate climate change but the lack of expertise worldwide has led to a period of trial and error. This period lasted for more than it should and the time has come for actions based on strategies and undertaken by experts in consultation with all stakeholders. Actions should be seen in a wider context and overseen by multidisciplinary teams to anticipate dysfunctions that can happen along the way as was stated in this paper.

This period of trial and error was certainly costly, time and cost wise. This lost won't be passed on to other nations who joined lately the mitigating climate change actions. PLEA is certainly the hub where experiences are exchanged to move on from trials actions to planned strategies.

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