

Implementing Code for Sustainable Homes (CSH) Level 6 in the UK's social housing sector

Hong Xiao (hong.xiao@bcu.ac.uk)

Birmingham School of the Built Environment, Birmingham City University, UK

Amanda Milambo (a.milambo@cem.ac.uk)

The College of Estate Management, UK

Abstract

In order to mitigate the impact of climate change on the environment, the UK government introduced the Code for Sustainable Homes (CSH) to guide house builders design and construct houses sustainably. The target is by 2016 all the new houses have to reach the highest of the CSH Level 6, i.e. "Zero carbon home". In light of this target, this research aims at investigating how to effectively implement Code 6 in the social housing sector. Social housing sector is selected because it counts about half of the new net added house units each year in the UK and the majority of the social housing projects are through public funding so they have the obligation to take the lead in meeting this target. Based on an extensive literature review and a semi-structured interview with practitioners (including architects, project managers, housing association managers and planning officers) who have been involved in social housing projects implementing CSH Level 6, this research found that the definition of the "Zero carbon home", though key to the achievement of Code Level 6, is in itself a barrier and 80% of the houses to be built will not be able to achieve the required standards. A culture change among the stakeholders is needed in order to wholeheartedly embrace the concept of sustainable construction so alternative house design and construction can be incorporated into the building process. The low carbon technologies are still too expensive and with limited choices, and not many sustainable materials can be sourced locally. But the experience gained from building lower level of CSH can prepare well the practitioners for Code Level 6 projects. Besides the various incentives from the government, clients / end users need be made aware of the benefits of this sustainable housing through reduced energy costs throughout the life cycle so that they will demand more sustainable development.

Keywords: Code for Sustainable Homes, Level 6, sustainable construction, social housing sector

1. Introduction

There has been growing concern of the impact humans and their activities are having on the environment (Pugh, 1996; Grubb *et al.*, 1999; Phillips, 2003; Wheeler, 2004). Finding ways of mitigating the impact of climate change became the focus of the international community in order to sustain the growing global population. This led the European Union (EU) to set targets for its member states (Victor, 2001), which left the UK government with no choice but make a strong commitment to cutting its CO₂ emissions by 60% by 2050 with real progress by 2020 (Grubb *et al.*, 1999; McEvoy *et al.*, 1999; Theobald and Walker, 2008). The construction industry was identified as being a major energy consumer. Activities within the industry were said to be responsible for the consumption of between 50% - 60% of the energy and about 46% of UK's CO₂ emissions come from buildings (Raynsford, 1999; Uher, 1999; Morton, 2002; Phillips, 2003; Dimitrijevic and Langford, 2007). The only way for the UK government to meet its ambitious target was through sustainable development.

One of the policies introduced by the UK government is the Code for Sustainable Homes (CSH). The CSH was first introduced in 2007 as a voluntary scheme for publicly funded housing projects. Its purpose was to be a pathway to achieve improved environmental performance for new homes by setting out minimum requirements that would help guide house builders on how best to design and construct homes sustainably (Al-Hassan, 2009; Osmani and O'Reilly, 2009; McManus *et al.*, 2010; STuDS, 2010). It was developed by the government in close collaboration with the Building Research Establishment (BRE) and the Construction Industry Research and Information Association (CIRIA) in consultation with most of the industry's stakeholders (DCLG, 2006).

As an environmental assessment tool, the CSH identifies nine key focus areas that are known to greatly impact on the environment and set out measures of how these can best be mitigated (DCLG, 2008): *Energy and CO₂ emissions; Surface water run-off; Water; Materials; Waste; Pollution; Health and well-being; Management; and Ecology*. The CSH is split into 6 ratings from Level 1 to Level 6, with Level 6 being the highest standard representative of a "Zero Carbon Home". It is the government's intention that Code Level 6 becomes mandatory for all housing projects from 2016 (DCLG, 2009; Osmani and O'Reilly, 2009; STuDs, 2010).

The CSH allows some flexibility and the responsibility lies with the developers to carefully consider which of the nine categories are practically achievable so as to obtain the necessary credits required. Despite this, there is a minimum standard at *each level* of the code for the Energy / CO₂ Emission and Water categories, a minimum standard at *code entry level* for the Materials, Surface water run-off, and Waste categories, but no minimum standard for the Pollution, Health and wellbeing, Management and Ecology categories (DCLG, 2008).

The social housing sector undertakes the main responsibility of providing affordable housing. Among the 121,200 net additional housing units in England in 2010-11, half of them (60,630) are social housing (DCLG, 2011a and 2011b). As a large proportion of social housing is public funded, they should take the lead in sustainable development. Hence, the social housing sector has been the focus for a lot of the policies that would enable meet government's sustainable development target. Although most of the social housing projects are now built to CSH Level 4 standard, there are a

number of challenges when it comes to meeting the requirements of Level 6. There is a big jump in the number of points currently required by Code Level 4 (68 points) to those of Level 6 (90 points), entailing much more stringent requirements. Building sustainably requires the use of low carbon technologies, which is still very expensive, making it less affordable and viable (Halliday, 2008; Roberts and Sims, 2008; McManus et al., 2010). This is of great concern to most of the stakeholders especially clients and developers who have to bear the cost yet are very profit driven (Morton, 2008). Moreover, developers and house builders need the necessary knowledge in order to make cost decisions relating to sustainable development (Carter, 2005).

Table 1 Levels of the CSH (DCLG, 2007)

<i>Code Level</i>	<i>Number of points required (including minimum standards)</i>	<i>Percentage reduction in CO₂ emission over Part L of the Building Regulations</i>
<i>1 (*)</i>	<i>36</i>	<i>10%</i>
<i>2 (**)</i>	<i>48</i>	<i>18%</i>
<i>3 (***)</i>	<i>57</i>	<i>25%</i>
<i>4 (****)</i>	<i>68</i>	<i>44%</i>
<i>5 (*****)</i>	<i>84</i>	<i>100%</i>
<i>6 (*****)</i>	<i>90</i>	<i>Zero Carbon Home</i>

The definition of “zero carbon home”, as required for Level 6, has attracted heated debate because different people have different interpretation (Guy, 2007; McManus et al., 2010). According to the DCLG (2006, pp 7), a zero carbon home refers to “zero net emissions of carbon dioxide (CO₂) from all energy use in the home”. With this definition, 80% of new homes would not be able to achieve CSH Level 6, so the definition itself becomes a key barrier (Brook, 2009). But there are other similar definitions, including *zero carbon* (i.e. no carbon-emitting fuels are burnt on site and no electricity is imported from the grid), *net zero carbon* (i.e. carbon-emitting fuels are burnt on site, but locally generated renewable energy is exported to the grid to make up for it), and *carbon neutral* (i.e. offsite generated renewable energy is imported from the grid or via private wires) (Guy, 2007), which may be more practical.

Most of the previous researches have focused on the technical aspect of the CSH i.e. amount of emission rate for a Code 3 house, carbon footprint analysis of levels 4 and 5 etc. Very little research has been conducted with regards to finding out how to practically achieve the CSH requirements on constructions sites. By studying the perceptions and experiences of the practitioners involved in social

housing pilot schemes in implementing Code Level 6, this research aims at investigating the challenges faced and the solutions adapted in practice and exploring ways of effectively achieving Code Level 6 in the social housing sector.

2. Research methodology

This research takes a qualitative approach because a lot of issues investigated are neither quantifiable nor comparable and the research findings will be mainly based upon practitioners' experiences, views and insights. Based on extensive literature review, semi-structured interviews were conducted to collect primary data. Semi-structured interview allows open-end questions to be asked so that the practitioners' experience and insights can be fully explored (Knight and Ruddock, 2008), and the responses from different key stakeholders can be compared and contrasted so that the complexity of the research subject can be understood from different perspectives.

To ensure the data collected from the interview is robust to address the research question, the respondents should have not only a good understanding of Code Level 6 and the relevant technical knowledge, but also direct experience in implementing it in social housing projects. As Code Level 6 will not become mandatory until 2016, there are very few projects that have been built to this high standard and practitioners available for this research are rather limited. The respondents were selected from two Code Level 6 pilot schemes, one in Northampton and the other in Birmingham, due to their geographical proximity to the researchers. In total, eight respondents were selected from across the different professions, all of which were involved at different stages of the pilot schemes. Although the size of the samples is relatively small and therefore not necessarily representative in terms of the experience, project type and location, this research does produce a useful snap shot on how the Code Level 6 is being implemented in social housing sector. Each stakeholder plays a different role at various levels of the projects hence they need to be included as part of the research sample. Among them, clients provide the funding for the projects, are involved at all levels of the project and are the key decision makers. Architects need to design the project up to the Code Level 6 standard. Planners are essentially involved in assessing and granting the planning applications and contractors are responsible for constructing the projects and ensuring that the standards for Code Level 6 are practically met. Table 2 shows the details of the respondents in this research.

3. Data collection

Most of the interviews were conducted face-to-face at the respondents' work places, except the two interviews with the planning officers, which were done on telephone due to the respondents' time restraint. On average, each interview lasted about 30 minutes and was recorded with the permission of the respondents. During the interview, the respondents were asked their knowledge and awareness of Code Level 6, how they implemented it in their projects, the problems met and how they were dealt with, and what should be done to promote this standard in the social housing sector as well as in the construction industry. In this section, the primary data collected from the interviews are presented.

Table 2 Respondents

<i>Respondent</i>	<i>Job Title</i>	<i>Project involved</i>
<i>A</i>	<i>Architect</i>	<i>Northampton</i>
<i>B</i>	<i>Contractor's Commercial Manager</i>	<i>Northampton</i>
<i>C</i>	<i>(Housing Association) Development Project Manager</i>	<i>Birmingham</i>
<i>D</i>	<i>Contractor's Senior Project Manager</i>	<i>Birmingham</i>
<i>E</i>	<i>Planning Officer in local council</i>	<i>Birmingham</i>
<i>F</i>	<i>Planning Officer in local council</i>	<i>Birmingham</i>
<i>G</i>	<i>Contractor's Development Manager (Architect)</i>	<i>Northampton</i>
<i>H</i>	<i>(Housing Association) Head of Project Development</i>	<i>Birmingham</i>

3.1 Knowledge of Code Level 6

Respondents B and D admitted that they had no knowledge and understanding of Code Level 6 prior to their involvement in the pilot schemes. While respondent B claimed there is no need of having background knowledge and understanding of Code Level 6, C insisted that a good understanding of the sustainable development and Code Level 6 helps create a certain level of appreciation of how building sustainably fits into the bigger picture. Being the planning officer at the local council, respondents E and F also admitted that they only had knowledge as far as the fact that Code Level 6 is a higher level of the CSH. This causes great concern as they are supposed to give planning permission and enforce building regulations but feel incapable of advising applicants in matters relating to sustainable construction due to lack of training. On the contrary, respondents A, G and H, who all have architectural backgrounds, seemed to have the technical knowledge of Code Level 6 and understood the steps leading up to its implementation. Because they have been involved directly or indirectly in the design of houses on a number of projects that were built to the Code Level 6 or any of the lower codes, they appeared more appreciative of the government's intention to introduce the Code Level 6 to meet the climate change challenge.

Interestingly, in both projects the idea of Code Level 6 was not the clients' original intention but instigated only during the construction phase. In the Northampton project the idea was initiated by the Architect more as a PR exercise and then sold to the client who was more than happy to fund it. In the Birmingham case the client thought they could market themselves better by incorporating units to Code Level 6 when the project was already underway, again another PR exercise. Not surprisingly,

from a contractor's point of view, respondent B claimed that the Code Level 6 standard only complicated their work because they did not view the scheme as one that was looking to build sustainably in order to save the environment.

3.2 Definition of Zero carbon and 2016 target

CSH defines Code Level 6 as "Zero carbon home". Respondents B, E and F had no knowledge of what a "zero carbon home" entails. Other respondents (A, C, D, G and H) believe it is difficult, if not impossible, to achieve in its current definition. Respondent C remarked:

"regardless of what you do, you can never avoid the emission of CO₂".

The main reason was that the process of fabrication, manufacturing and transportation of materials unavoidably produces a certain amount of CO₂. When referring to the definition relating to sites being able to generate their own power through renewable sources or even exporting to the grid, respondents G and H believed that the social housing sector has not yet reached the stage where sites are able to support their operations without importing energy from the grid. On the other hand, respondent D claims it is possible to achieve Code 6 using *carbon neutral* as opposed to the current definition "zero carbon home" by the government.

Most of the respondents agreed that it is necessary for the government to introduce policies that would help mitigate the impact of climate change on the environment, but they also consider the requirements of Code Level 6 too stringent and the expectation is too high and that the industry needs more time to adjust, as highlighted by A:

"Countries like Germany started looking into sustainable development from the 1970s, which is what the UK government has been trying to do only in the last 5 years".

All the respondents apart from C believed the 2016 target is too ambitious. Respondent A further pointed out that stakeholders have to change their mind-sets to accommodate alternative methods of construction. Respondents B and G believed that, although technically this date is feasible, the current economic climate will pose a great challenge, thereby making 2016 a farfetched reality. Respondent D thought the blame lay on "technology not being able to keep pace with the demand", and suggested the need for further investment to accommodate the growing demand for the available technology.

3.3 Meeting of Code Level 6 Standards

According to respondent G, meeting the Code Level 6 requirements needs to begin from design stage. This includes taking into account orientation of the building, achieving of energy levels within a competitive budget, maximizing on day lighting and determining the transportation of the excess materials. But it is usually not the case as demonstrated in the two pilot schemes.

All the respondents agreed that the most efficient way of meeting Code Level 6 standards is through the careful consideration of the individual requirements and available technologies. Respondent D further pointed out that it is best to avoid the untested new technologies, which may be unreliable and would just complicate matters on any building site and hamper the achievement of the CSH Standards.

Respondent G perceived water usage to be the most difficult to achieve, due to lack of knowledge by end users. Home owners need to ensure a certain amount of water is used per person per day to meet the requirements, which may be beyond of the control of the construction project team. Respondent G viewed that surface water run-off is another category difficult to achieve because it is dependent on the site ground conditions which the stakeholders have no control over. Poor site conditions and the construction activities on site require robust mitigating measures to reduce surface water run-off. Both respondents A and B agreed that management is the most challenging due to the amount of paperwork required to record material deliveries, workforce mileage, Considerate Constructor Scheme etc. It requires not only the main contractors' contribution but subcontractors' too, as respondent B pointed out:

“All people need to buy into the requirements for it to be achieved”.

3.4 Problems encountered

As mentioned earlier, the two projects were initially designed to only achieve Code Level 4, and the upgrading to Code Level 6 caused problems due to design variation and cost increase. To iron out the potential conflicts within the team and get everyone on-board, respondent G suggested that:

“The design should be put together through the consultation of all team members and not just through the aspiration of either the Architect or Client.”

Workmanship was identified as a problem in terms of achieving Code Level 6 standard by both contractor respondents H and D. Respondent D exemplified this with the fact that his first Code Level 6 house failed the air test due to flaws in the building process. Lessons learnt were applied in his second house through better workmanship, which significantly improved the quality of the finished product.

The construction industry's culture is another barrier to the effective implementation of Code Level 6 standard, according to respondents A and H. They claimed that most people within the social housing sector as well as the wider industry are resistant to changes and their excuse is “*We've always done things this way, why change now?*”? Respondent H contended that the culture in the construction industry has caused BRE to maintain the use of bricks and mortar as opposed to the more sustainable material such as timber because BRE fear the controversy or even uproar any recommendations leaning towards the use of timber might cause.

Another fundamental problem faced by contractors, as pointed out by respondent G, was that many materials are not locally available. In the Northampton project, the timber oak frames used, although a more sustainable choice, could not be sourced locally, but to be imported from Europe. The transportation of the materials not only had cost implications, but contributed to CO₂ emission. The leading time also had an impact on the programme.

3.5 Low carbon technologies

The respondents pointed out there are very limited low carbon technologies available on the market. The most commonly used ones are Photovoltaic (PV) panels, heat exchange units, and grey water harvesting, which are still very expensive as there are only a few suppliers specialising in them. Most suppliers are not keen in supplying materials related to new technologies due to inadequate knowledge and additional costs involved.

Respondent D mentioned the problems when installing PV panels. Despite having followed the specification of “one connection pipe in on a slow bend and one out” in installation, it was apparent that actually two feeds were needed. Though a minor setback, respondent D felt frustrated and it had an impact on the programme. However, on his next housing unit, the PV panels were installed very efficiently due to the lessons learned from the previous house.

Respondent B reported that it took long to choose the most suitable wind turbine in his project due to lack of adequate knowledge and understanding of the new technology. To solve the problem, respondent G suggested that specialist subcontractors installing low carbon technologies should be involved from design stage so they can bring onto the table their knowledge and understanding, which in turn will ensure that these technologies can be incorporated into the project more effectively.

3.6 Promoting Code Level 6

The demand for sustainable homes is still weak on the market due to the current economic recession and lack of knowledge and awareness of Code Level 6. All the respondents were quite enthusiastic about the government’s introduction of Code Level 6 in the social housing sector. They were willing to promote Code Level 6 as one of the measures to encourage other stakeholders in the sector towards sustainable development. They agreed that the best way of promoting Code Level 6 is by government introducing incentives such as grants and tax rebates. Besides the “carrots”, respondent H strongly believed that the most feasible way of achieving Code Level 6 is through building regulations which leaves stakeholders with no option but to comply.

Respondent A thought seminars that involve manufacturers, suppliers, clients and contractors can update stakeholders on any changes affecting Part L of the building regulations. Respondents C, D and G believed that Code Level 6 can be best promoted through homes that have been built to its standards because through monitoring the energy bills future clients and customers can see themselves

how energy efficient these homes can be so that they can be confident that in long term they will be able to recoup the initial investment through reduced energy bills.

4. Discussion

Although not necessarily representative, the fact that these two pilot schemes were only upgraded from Code Level 4 to Level 6 after the projects had already started indicates that there is a lack of urgency and willingness within the social housing sector as well as the wider industry to implement the higher level of CSH. This may be because as Code Level 6 is becoming mandatory only from 2016, people might think there is still time. Moreover, homes with Code Level 6 are undoubtedly more expensive, and in the current global economic recession, clients are understandably very cautious of their investment, especially in social housing sector where the clients are not the end users and may not eventually benefit financially from the more sustainable homes. But not incorporating the Code Level 6 from the beginning of the pilot schemes disregards the whole intention of the CSH, which is the minimum standards to guide house builders how best to design and construction homes sustainably (STuDs, 2010). This has a negative impact on the implementation because key factors such as building orientation, inappropriate site conditions, ecological aspects of the site etc. cannot be fully considered, resulting in design variations, change of materials and ultimately unnecessary cost increase. As Code Level 6 assessments are carried out at both design and post construction stages, it is fundamental to incorporate their requirements into the design (Al-Hassan, 2008). Without it, Code Level 6 simply cannot be achieved. A culture change is needed within the industry so that everyone wholeheartedly embraces the idea of sustainable development. Clients should take the lead in Code Level 6 schemes because they are the main funder of the projects and make most of the key decisions, but every stakeholder should get on board from the very beginning so that the full benefits of sustainable development can be effectively achieved.

The research result shows that the knowledge and experience of CSH is of great benefit on site as it will allow the practitioners to be more appreciative of the principle of sustainable development and therefore be more willing and able to contribute. Experience gained from building lower levels of CSH can prepare the practitioners for the forthcoming mandatory Code Level 6 standard as both the managerial staff and operatives need to be exposed to the new construction methods and sustainable technologies. Lessons learned are transferable as demonstrated in respondent D's examples. It is quite worrying that both planning officers do not have much knowledge about Code Level 6. Therefore, better promotion and training of Code Level 6 is urgently needed among all the stakeholders.

It is evident from this research that the current definition of a "zero carbon home" is basically not achievable in the social housing sector as the requirements are too stringent. The government needs to consider some of the alternative definitions such as "carbon neutral" to make the Code Level 6 more practical and achievable. Otherwise, the 2016 target will become a mission impossible. The new low carbon technologies are also of some concern because there are only very limited proven technologies available on the market and they are very expensive due to lack of competition. The installation of these technologies requires a new form of competency and knowledge which is lacking among contractors (Williams and Dair, 2006). To make matters worse the integration of these technologies

can at times be unreliable (Osmani, and O'Reilly, 2009). Therefore, reliable yet affordable low carbon technologies need to be developed to keep pace with the increasing demand for sustainable homes.

The categories identified as the most difficult to meet are water, surface water run-off and management, all of which have elements beyond the control of the project team. While Code Level 6 has a definite requirement on water usage, CSH has only a minimum standard at entrance level for surface water run-off at entry level and no minimum standard for management. Such flexibility allows the project team to trade-off between categories and achieve the required credits more efficiently according to the specific conditions of each project. But the sustainable materials such as timber unavailable locally is problematic as it means either less sustainable materials will be used or the carbon foot print will be increased by importing them abroad. More research and investment from both the government and private sector is urgently needed in this area.

5. Conclusion

With the ever growing concern of the impact of climate change on the environment, the UK government has introduced CSH to guide house builders to design and construct houses sustainably. The highest of the ratings within the CSH is Level 6 which the government is seeking to become mandatory from 2016. Based on extensive literature review, this research investigated the barriers in the implementation of CSH Level 6 through the experience and opinions of practitioners involved in two pilot social housing schemes in the Midlands.

The research found that a culture change is needed in the social housing sector so that all the stakeholders will have the necessary knowledge and experience to appreciate and embrace the principle of sustainable development and implement it in practice. Although the requirements of Code Level 6 seems stringent, a level of flexibility exists and it is possible to achieve the required credits through careful trade-off between different categories and through available technologies, but this has to start from the very beginning of a project and get everybody on board as soon as possible, otherwise it would be very costly. It recognised that the definition of a “Zero carbon home”, which is key to the achievement of Code Level 6, needs to be amended. The availability of locally sourced materials poses a challenge for contractors so investment is needed to supply such materials on a large scale in the future.

To promote Code Level 6, the government should introduce incentives such as grants, discounts on low carbon technologies, stamp duty exemption for greener homes and give tax breaks for energy efficient homes to stimulate such demand. Building regulations should be amended regularly to reflect the development of technology and environmental requirements. Monitoring the performance of completed homes built to Code Level 6 and providing the feedback to future clients and end users can also effectively promote the sustainable homes.

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