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# The Code for Sustainable Homes in the UK: Affordability and Future

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## ABSTRACT

*UK agreed to reduce 80% of emissions by year 2050. Government therefore expects to ensure sustainable homes with emissions are available to all householders in the UK. Accordingly, new legislations are enforced to ensure that all new homes are adhered to Code for Sustainable Homes (CSH). CSH is a national standard rating system to guide the industry in having sustainable design and construction. Despite the obvious benefits such as lowered emissions and energy efficiencies, CSH indicates problems of affordability especially during current economic downturn.*

*The paper examines the UK code for sustainable homes and evaluates benefits and challenges it has. The paper also investigates whether the sustainable homes concept along with the green construction could be affected by the economic downturn in the UK. A comprehensive literature review based on recent government reports, journal articles and books is carried out to fulfil the aim of this paper. The research findings witness the up-front cost of integral green features that needs to be used as part of the CSH hence both consumers' and construction clients' incapability to bear the high costs. To improve supply side, the UK government provides "green loans" and other incentive for developers and consumers. With the improvements in the demand market, CSH would lead to create more "green jobs" in the supply chain. Further, the sustainable home development will play an important role to bring prosperity in construction industry and the overall economy.*

**Keywords:** *Climate change, Code for Sustainable Homes, Construction Industry, Recession,*

## 1. INTRODUCTION

The emission of green house gases results in global warming is evident by the increased air and ocean temperatures, melting down of snow and ice, and rising sea level. The world leaders agreed on a global deal in Copenhagen to tackle climate change and to reverse global warming (Watts, 2009). The World Wildlife Fund (2006) added that carbon dioxide (CO<sub>2</sub>) emissions have not decreased in United Kingdom (UK) since 1990. Two-third of these emissions is produced from homes, non-residential building and construction industry.

There are approximately 25 million homes in the UK which account for 27% of total emission (Committee of Climate Change, 2009). The UK health secretary has recently warned that the climate change causes the communities to encounter with associated costs to health such as heart and breathing problems. Consequently, UK government has agreed with Committee of Climate Change (2009) on the Carbon Budgets plan to reduce homes emission by 35% on today's level by 2022 and determine to have 80% cut in greenhouse gases by 2050 in return for better environmental and human health (Higginson, 2009).

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The new legislation enforced in April 2008 that, all new homes construction must comply with the standards established by Building Research Establishment Assessment Method (BREEAM) who cooperate with Communities and Local Government to provide guidance in adopting Code for Sustainable Homes. The Code for Sustainable Homes is a national standard rating system to guide the industry in having sustainable design and construction. By year 2016, it is mandatory that all homes build to zero carbon (BREEAM, 2009).

## **2. RESEARCH METHOD**

The paper aims to evaluate the Code for Sustainable Homes, its benefits and challenges based on secondary data collection. The UK government reports, journal articles and books are reviewed to fulfil the aim of the paper. Accordingly, the paper is structured as follows. Component parts of the Code for Sustainable Homes are presented along with examples of green technologies used for sustainable homes. This is followed by the UK governments' incentives that are offered to promote sustainable homes. Benefits and challenges associated with the sustainable homes are evaluated next. Finally, discussions are carried out to ascertain whether sustainable homes can withstand the UK economic downturn.

## **3. SUSTAINABLE HOMES: WHAT IS IT?**

To the forefront, when the target to make all social housing decent by 2010 was first set, a decent home has been defined to be wind and weather tight, warm and has modern facilities (Wilson, 2003). The BREEAM (2009) has established the Code of Sustainable Homes which is an assessment for the design and construction process of new homes in complying with the required standards for energy efficiency and sustainability to ensure for a reasonable degree of thermal comfort. Most importantly, it encourages the households to live in a sustainable lifestyle such as creates less waste, reduction in water and electricity usage in result for a lower running cost. Therefore, the home builders must take into account of the Code rating system which sets the standards for sustainable design principles: energy efficiency, water efficiency, surface water runoff, site waste and household waste, use of materials, pollution, health and well-being, and management and Ecology (Communities and Local Government, 2006).

The levels of Code is ranging from one to six in which all new housing must be built with a minimum of Code level 3 starting from 1<sup>st</sup> of May 2008. The housing has been divided into two categories as public affordable housing and private housing. For public affordable housing, it has been mandatory to achieve Code level 3 since 2007. From year 2010, all affordable homes must be built with Code level 4. From 2013 onwards, it has to achieve Code level 6. With regard to private housing, it has to achieve Code level 3 starting from 2011 and it will be updated to Code level 4 in year 2013 and Code level 6 from years 2016 onwards (Maunsell, 2007).

The Code levels act as a sustainable rating system indicated by 'stars' to communicate the overall sustainability performance of a home. A home can achieve a rating from one to six stars depending on the extent to which it has achieved code standards (one star is the entry level and six stars is the highest level). The stars are calculated on a 'points out of 100' basis across the nine design principles mentioned above. Among the nine principles, for energy efficiency and water efficiency there are minimum standards at each Code level (Communities and Local Government, 2006). This emphasise the importance of energy and water efficiency towards sustainable homes. For some of the other design principles, there are minimum standards to achieve the entry level and for some there are no minimum standards (refer Table 1). This provides the flexibility for the developer to select the sustainable Code that they are targeting and choose the appropriate green technologies accordingly.

Table 1: Minimum standards of the Code for Sustainable Homes

Design Categories	Flexibility
<b>Energy Water</b>	Minimum standards at each level of the Code from 1 to 6
<b>Materials Surface water run-off Waste</b>	Minimum standard at Code entry level (Code 1)
<b>Pollution Health and well-being Management Ecology</b>	No minimum standards

Points are awarded for meeting or exceeding a combination of principles. Thus, it allows the developers to choose which and how many standards that must be achieved at every level of the Code. Due to the new legislation stating the housing must compliance with a minimum of Code level 3, ratings has to be run from the minimum of 3 Stars, where a house is 25 per cent more efficient. Besides, Code level 6 is a completely zero carbon home which require highest overall point to gain the ratings (refer Table 2). Designers are required to achieve increasingly stringent criteria to reach each level of the Code’s requirements.

Table 2: Summary of points and requirements for each of the six star ratings

Summary of points required for each of the six star ratings, incorporating the design categories’ flexibility allowance						
	Design category 1 ENERGY/CO2		Design category 2 WATER		Design categories 3 to 9	Equivalent BRE Eco- home rating
	Energy standard (% improvement over Part L 2006)	Energy points awarded	Water standard (litre per person per day)	Water points awarded	Other points required	
<b>Level 3 *** 57 points</b>	25%	5.8	105	4.5	46.7	Very good
<b>Example: Level 3 shows that 57 points required to meet compliance: i.e. 5.8 points awarded for category 1 4.5 points awarded for category 2 46.7 points warded for other categories from 3 to 9</b>						
<b>Level 4 **** 68points</b>	44%	9.4	105	4.5	54.1	Excellent
<b>Level 5 ***** 84 points</b>	100%	16.4	80	7.5	60.1	N/A
<b>Level 6 ***** 90 points</b>	ZERO CARBON	17.6	80	7.5	64.9	N/A

#### 4. THE GREEN DESIGNS

This section detail out the difference of green designs criteria integrated among the Code level 3, 4 and 6 where attention will be focused on one of the nine principles: energy efficiency as it is the main factor that contributes to the environment pollution. The comparison will be carried out based on a scenario where detached house is used.

Mead (2009) asserts that the building fabric has the biggest cost impact toward the total sustainable development cost in any of the Code level. Commonly, cavity wall will be used as the fabric or the timber panels are alternately used in which the average cost of building fabric is about £15k. When the building fabric been put into the discussion, the BREEAM (2009) is actually concerning the thermal performance of building which indicating the U-values. Whereby, the thermal bridging at the junctions such as wall-floor; wall-roof; jambs; lintels and other significant junctions where heat can easily escape will be accounted to the design stage. Moreover, the insulation of cavity wall is to prevent the diffusion of heat into the wall (Goulding *et al.*, 1992). This is important as the inefficiency of the fabric insulation will leads to power loss in result for higher energy consumption. In Code levels 3, 4 and 6, the U-values are less than 0.15, 0.18 and 0.11 respectively (Mead, 2009). This indicates the thermal conductivity is improving and getting more efficiency in these sustainable homes.

The element of window is considers as part of the building fabric plays an important role that affects the thermal transmission. It is mandatory for all Code levels to integrate with triple glazed windows. It is not only giving internal thermal comfort by preventing heat from escaping, but also providing condensation protection which prevents dropping of indoor humidity during winter (Mead, 2009). It is more energy efficient as the usage of heater and humidifier will be significantly lowered down. In terms of air tightness, the rate of leakage in Code level 3 is not exceeding 3m<sup>3</sup>/hrm<sup>2</sup> compare to Code level 4 and 6 of not exceeding 1m<sup>3</sup>/hrm<sup>2</sup> (Mead, 2009). This shows that the flow of air through the gaps of fabric is well controlled in Code level 4 and above which reduced the heat loss during winter (Energy Saving Trust, 2002). However, design for natural air ventilation will be still needed in a home for health reasons.

Housing ranging in all Code levels must install Mechanical Ventilation Heat Recovering (MVHR) system where it conserves energy by recovering heat from extracted air and works in both ways. For example, if the outdoor temperature is higher than inside, MVHR helps to maintain internal comfort level. Furthermore, heating systems such as gas boiler (solar water heating and photovoltaic panels), biomass boiler and heat pump will be installed in each Code level. The only difference will be found in the combination of technologies to achieve different level of energy efficiency (refer table 3). For example, water heating in Code level 3 will be using 210 litre dual coil cylinder with 50mm insulation. However, the system of 160 litre dual coil cylinder with 80mm insulation will be employed from Code level 4 onwards. Hence, higher Code levels will be utilising higher insulation to improve the heat from being loss easily, giving more sustainability to the environment. Besides, in terms of the low energy lighting, Energy Saving Trust (2009) recorded that 75% low-energy lighting and appliance is used in Code level 3 and those are of 100% low-energy will be used in Code level 4 to 6.

Through the studies of the Code levels, it is evident that all Code levels are generally utilising the same green technologies which mentioned above and there is a wide range of solutions in delivering the required target.

Code Level	Technology Combinations
3	Best practice energy efficiency plus solar water heating
4	Advanced practice energy efficiency plus photovoltaic Best practice energy efficiency plus photovoltaic Part L energy efficiency plus photovoltaic
5	Best practice energy efficiency plus biomass district heating Best practice energy efficiency plus gas fired combined heat and power (CHP) Best practice energy efficiency plus biomass heat and power (CHP)

Table 3: Combinations of green technologies (Maunsell, 2007)

The technologies are different in terms of its capability to achieve energy efficiency and it tends to be more advance for higher Code levels (refer Table 4). However, the Code level 3 achieves its energy efficiency by depending more on the building fabric improvements. In comparison with Code level 5 and 6, it is massively reliant on the renewable technologies which are expensive and difficult to be achieved. Table 4 below shows the cost transition between the Code levels where the cost ranges from a flat to a detached house.

Code Level	Extra Build Cost (relative to 2006 Building Regulations in £)
From 3 to 4	4-5% (2,900 - 4,400)
From 4 to 5	5-9% (3,900 - 8,700)
From 5 to 6	10-14% (7,700 – 13,100)0-14% (7,700 – 13,100)

Table 4: Extra over cost relative to conventional construction (Maunsell, 2007)

Having discussed some examples of green designs related to energy efficiency, the section below provides the initiatives taken by the UK government in promoting sustainable homes.

## 5.SUSTAINABLE HOMES: INITIATIVES FROM THE UK GOVERNMENT

Under the new green strategy of Communities and Local Government (2010), the government aimed to insulate 6 million “green homes” by the end of year 2011 across UK. The strategy plan will help to reduce the upfront cost by providing ‘Pay As You Save’ (PAYS) green loan which tied to the property and encompassing two sources of funding (Communities and Local Government, 2010). Firstly, it targets those vulnerable households and tenants with low income and having the energy companies to subsidise them to install the standard insulations as well as eco upgrades such as fitted smart meters which can save approximately £300 a year on bills (Department of Energy and Climate Change, 2010). Secondly, householders who have an eco upgrade or have installed renewable heat

technologies are entitled from significantly reduced bills and guaranteed revenue stream (Department of Energy and Climate Change, 2010). This is to ensure they do save on bills or the revenue from small scale renewable, to cover the costs of eco upgrade. Besides, in order to educate the householders about improvement in energy efficiency that they can make at home, the government established a 'one-stop' shop energy helpline and an online modelling system enabling the householders to access relevant information. In addition, the government provides also an eco show home to demonstrate money saving by integrating the carbon saving technologies at home (Communities and Local Government, 2010).

Apart from cultivating confidence of using PAYS strategy in consumers, the government promotes behaviour change by having Department of Energy and Climate Change for funding new initiatives with a small group of leading employers who in turn mobilise their employees to insulate their homes. This is another way to promote the eco upgrade, leading the staff members to have better understanding about the benefits of practice which then enabling them to achieve money and energy savings.

## **6.SUSTAINABLE HOMES: BENEFITS**

### ***6.1.BENEFITS FOR ENVIRONMENT***

One quarter of UK emissions are coming from energy used in homes. With the Greener Homes Strategy to mitigate the emission hurdles, the minimum standards for energy efficiency must be achieved in each of the Code level. This in turn results for a reduction in greenhouse gas emissions and make a contribution to achieve UK's emission cut target agreed in Act on Copenhagen (2010) for tackling climate change. The Communities and Local Government (2006) concluded that with the integration of green technologies, the building make better adaptation to the impacts of climate change. The integrations are such as the minimum standards for water efficiency and other measures that being enforced, including better management of surface water run-off (Communities and Local Government, 2006).

Authors argue that 'better adaptation' would leads to make the building more resilient to natural disasters. By building a more environmental friendly manner, it reduces the possibility of building failure which resulting from weather extremes. The Code level provides a good basis for building design which will not invade by the weather. In addition, Code level encourages the households to create less polluting waste and to practice recycling at home.

### ***6.2. BENEFITS FOR CONSUMERS***

The government has been providing facilities to assist the public to identify the Code for Sustainability, thus enabling the public to be able to make a right choice in purchasing a green products or a green home (Communities and Local Government, 2006). It is important to move forward and make sustainability a part of cultural where people start to be aware of energy efficiency and conservation to reduce carbon footprint to achieve sustainability. Besides, a green home emphasises the level of comfort and satisfaction of consumers by improving health and well-being, providing a livable environment.

Consumers are directly benefited from the green technologies usage which cut down bill costs approximately £300 a year through greater energy and water efficiency. The use of fossil fuels to

generate energy has not been included in the Code whereby, home owners who purchase a green home are helping to reduce fuel poverty (Department of Energy and Climate Change, 2010). Through the studies, it has drawn to authors' attention that people tend to be more alert on monthly bill costs and neglect about maintenance costs. Logically, the use of green technologies will lead to have a durable and long lifespan property which not requires frequent repairs to maintain (Mead, 2009) and also yield for a higher house value (Kibert, 2008). The authors argue that this is greatly beneficial to the customers as their investment made in a green home will not depreciate in the long-term as demand for sustainable home is growing higher and sustainability is already part and partial of the world.

### ***6.3.BENEFITS FOR HOME BUILDERS***

The public are adopting more sustainable lifestyle, as stressed and as a result, home builders who are able to show their concerns and utilise the carbon saving technologies in the housing construction will perform well to compete in the market (Communities and Local Government, 2006). Use of green technologies and designs provides quality assurance and add value to the builder's professional profile (Howard, 2009). Apart from that, the authors supposed the new legislation has stressed on the proper procedures in design and construction to work out a green home in order to deliver the quality and durability measures. In this regard, it definitely helps to prevent from defects during operation period, reducing builder's liability and the risk of claims and litigation involvement (Kibert, 2008). Besides, Mills (2005) states that any projects that are able to adapt with the climate change will reduce the need of risk management in construction.

### ***6.4.BENEFITS FOR ECONOMY***

The transition to low carbon economy, the demand for sustainable sector is getting higher and it has been reported that it yields for 65,000 jobs creation in the construction industry (Department of Energy and Climate Change, 2010). It opens up a wider market for the supply chain in identifying the environmental market opportunities such as solid wall installation and micro-generation installation (Khan, 1997). Hence, the supply chain is able to expand and diversify businesses and benefit from the market segmentation (Osmani and O'Reilly, 2009). The Code for Sustainability encourages the suppliers to be technologically innovative to improve the green designs and functions to achieving higher level of efficiency and effectiveness. Further, the Act on Copenhagen (2010) claims that low carbon business generates £107 billion a year in UK and employs 880,000 people.

## **7.SUSTAINABLE HOMES: CHALLENGES**

In making the way towards a low carbon scenario, it is inevitable to encounter obstacles especially as the UK economy is still in a recession. The section below explores views from demand and supply sides in the market sustainable homes.

### ***7.1.CONSUMERS' PERSPECTIVE***

Koerner (2007) revealed that the average consumers are lack of knowledge about energy-efficient designs. Some of the homeowners whose affordability is well above the average may request for a larger home. However, higher level of capability of green technologies such as heating and cooling systems, water distribution schematics, and building envelop design will be needed to apply into a large size homes. It therefore requires significant amount of material and energy to insulate homes that will account into wastage of resources which is discouraged by the sustainable strategies. A survey carried out by WWF (2007) found out that most of the home buyers are environmental conscious and will support for energy efficient scheme. However, the survey has shown that majority of the consumers are not willing to pay more for sustainability features due to two main reasons.



Firstly, the economic recession has deprived consumer's saving rates which in turn affecting their purchasing power in the property market. Secondly, the consumers claim the maintenance cost is expensive and expressed their incapability to afford for the fee though maintenance will only be needed for once or twice a year (Bretherton and Pleace, 2008).

## **7.2. CLIENTS' AND BUILDERS' PERSPECTIVE**

The government has recently announced that councils who fail to release land for house-building will experience difficulties in getting approval for their planning system (Gardiner, 2010). In addition with the consumers who are starting to see the environmental impacts and possible costs to their green home operations, challenges the developers to build green homes more cost-effectively (WWF, 2007). However, Mead (2009) claims that developers are usually unaware of the increment of design fee and pre-planning fee for the low carbon development. When a green construction is over budgeted, the developers tend to "value engineer" the costs of green features. Osmani and O'Reilly (2009) point out, UK house builders are using a range of standard house sets across their developments to help reduce costs and defects and as a consequence, they are reluctant to adopt policies which require excessive design changes. This is due to the traditional attitudes are still maintained among the builders, which limit the overall uptake of innovations. In fact, the builders are acting in accordance with the sustainability requirements of the clients as mentioned above who would preferably willing to go without green features. Furthermore, the cost of achieving different Code levels will vary depending on the economies of scale available to each particular house builder and the construction methods employed (Osmani and O'Reilly, 2009). Further, Osmani and O'Reilly (2009) challenge the views of Department of Energy and Climate Change (2010) that mentioned about increased amount of jobs related to green technologies (refer section 6.4). However, the authors believe that the UK government is the prime source of boosting the job creation as it is essential to develop a sustainable community and social housing for those who cannot afford sustainable housing whilst reducing the poverty and unemployment rates in the UK.

Above sections evaluated the benefits and challenges of sustainable homes. At present, the UK economy is experiencing a recession which exerts a certain level of impact on the housing market and further weakening the demand for sustainable housing. Accordingly, the section below discusses whether sustainable homes can defeat the impacts from recession.

## **8. CAN SUSTAINABLE HOMES WITHSTAND THE RECESSION?**

A negative economic growth is indicating low unemployment; cut in mortgages; poverty; shrink in contractor's profit; low interest rates and inflation of fuel and energy prices. The effects from the recession have been witnessed in the housing market where housing prices is falling and urges the lenders to cut mortgage rates to beat competition. This shows the incapability of general public to afford a home albeit with a lower sale price. The aforementioned factors also indicate weakened demand in the housing market and lack of capabilities of the population to afford a home. This is regardless to mention the sustainable homes which need greater investment due to its high initial cost compared to conventional homes (Howard, 2009). Furthermore, the UK Green Building Council (UK GBC) recently investigated whether the financial crisis has impacted on organisations in tackling sustainability (CIOB, 2009). 18% of UK GBC members responded that the credit crunch has had an adverse effect on efforts to address sustainability (CIOB, 2009). Also, the survey revealed that half (53%) of projects tendered for sustainability was not a client's requirement (CIOB, 2009). This shows the weak demand in the sustainable housing market.

On the other hand, there are positive impacts to the sustainable sector during the recession. As indicated in section 6, there are improvements in certain areas of sustainable development. The authors assert that this has a connection with the issue of rising green jobs and skills. The UK businesses have the potential to gain a share of the global market for low carbon goods and services

(Act on Copenhagen, 2010) that opens up a new door for the UK market. By providing services and producing the goods, it helps create employment to the community in which we called the 'green job'. It helps also to stimulate the innovation to produce sustainable technologies and design (CIOB 2009).

Throughout all these circumstances, is that really a truth where recession is a major cause that people unable to afford sustainability? Or, are they merely misunderstandings on having sustainable development? The authors argue that referring to expensive initial cost as a barrier to move forward towards a low carbon premise, is an excuse to confront the recession as consequence of environmental collapse is much greater than the current economic downturn.

Sustainable development is not about cutting and saving cost in the long-run, nor merely making a commitment to the Kyoto Protocol to cut emissions. The 1972 Stockholm Declaration on the Human Environment Conference clarified concisely that environmental, economic and social issues were inseparable and that a systemic approach should be adopted if true sustainable development is to be realised (Birchall, 2003). Furthermore, the sustainable development policy in the UK states that "Sustainable Development does not mean having less economic development: on the contrary a healthy economy is better able to generate the resources to meet people's needs and new investment and environmental improvement often go hand in hand" (Orsatti, 2006). This is a good view point to oppose the opinion of Victor (2001), who claims that the Kyoto Protocol retards the economy and construction industry. Victor (2001) claims that most of greenhouse gases come from burning fossil fuels for energy and use of energy equipment such as power plants, automobiles that has a long life span. Thus he argues that if we are to comply with Kyoto Protocol, most of the premature energy equipments needs to be disposed, which will reduce the emissions as well as retards the economy.

Some believe that one of the key reasons for the current economic downturn is due to unsustainable business practices and being very much concerned on profits and not adequately focusing on making a balance between monetary gains with social and environmental aspects. Organisations, communities and individuals therefore now have the opportunity to show that they are not just motivated by short-term profits, but a long-term strategy that balances socially responsible initiatives.

## **9. CONCLUSION**

There are varying opinions as to whether the sustainable market survives in the future. However, the authors can conclude that these judgments are no longer an issue when compared to the adverse impacts that could come to UK if actions against climate change are not taken. As revealed by the European Environment and Health Committee (2010), 70% of UK population living in the most polluted areas that severely threatens human health. In fact, it is indeed becoming a major constraint on country's development as humanity is the main economy driver.

The Code for Sustainable Homes with its nine design principles are focused on reducing emissions and pollutions whilst promoting sustainable development as a whole. As discussed within the paper consumers' affordability is being highly concerned as it affects the execution of this mandate green scheme. Also, there is lack of collaboration between the contractors and clients due to financial hurdles which causes a barrier to the growth of sustainability. Although it is inevitable to bear the up-front cost, the benefits of adhering to the Code is generally long-term. Homeowners need to pay extra money on top of a conventional house construction to make their homes sustainable. Affordability of a sustainable home adhering to the Code is therefore a challenge for the UK citizens especially during the current economic down turn and even within a normal economic climate. Therefore, continuous government support to boost the demand of the homeowners such as subsidies for installation of green technologies and stamp duty relief etc. are needed. Moreover, a guaranteed market for the suppliers needs to be established so as to reduce the cost to the suppliers whilst increasing the availability of the green technologies in the market. In this respect, introducing legislations related to sustainable homes will motivate and get the commitment of the homeowners to move towards sustainable development and zero carbon homes. Investments made in the sustainable sector will give long-term benefits in

return such as better adaptation; improve environment and human health; reduce carbon footprint; low operation cost; provide sustainability credentials; risk reductions; insurance cost reduction; long life span of homes and jobs creation.

In promoting the Code for Sustainable homes, the UK government is facilitating financial assistance and enables the public to understand the importance of sustainable development as a whole. In terms of the construction industry, sustainable housing can be identified as an area that brings technological innovations and opens new dimensions to the construction supply chain. Further, the creation of green jobs related to sustainable homes could be one of the mechanisms that help to recover from the economic downturn. As climate change is a serious and urgent issue, it is vital that everyone supports the sustainable home scheme. Sustainable housing provides us with improved overall well-being and quality of life. It also leads to economic prosperity, stimulates social cohesion, provides security, supports social welfare and is designed to enhance personal community and global health. Therefore, it brings together environmental, social, economic, cultural and political dimensions into a single agenda.

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