

# Towards More Sustainable Built Environments

Richard Laing

**Abstract** The built environment in Europe accounts for around half of all energy use across the community. Therefore, drives to improve the sustainability of Europe and its member states have contained numerous initiatives and mechanisms through which energy use and carbon emissions can be reduced. It is important to remember that the built environment is far from homogenous, though, and that the buildings and structures already existing require a variety of approaches. It can also be argued that energy used through the constructed environment is driven by the people inhabiting and using buildings. Therefore, significant efforts have been made to explore and influence human behaviour with regard to sustainable lifestyles. It is also true that buildings exist as part of a wider landscape, rather than in detached isolation. Therefore, various initiatives have attempted to identify such connectivity, and to explore how emerging technologies can begin to drive sustainable changes. This chapter presents an overview of strategies which have developed across Europe, and discusses the responses which can be witnessed at the national and local levels.

## 1 Introduction

There has been a growing acceptance of the need to change both technologies and behaviour in response to climate change over a period of many years. Buildings account for somewhere between 40 and 60 % of energy use across Europe, with variations due to climate, location, use and design. Therefore, at a policy level, there have been a series of strategies and policies developed to address the

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R. Laing (✉)

The Scott Sutherland School, Robert Gordon University, Aberdeen, UK  
e-mail: r.laing@rgu.ac.uk

possibility of increasing energy scarcity, with those often having a direct effect on the way in which we plan for, design, build and use the built environment.

CIC Start Online is an excellent example of an initiative which managed to apply technical expertise in sustainable design to help improve the industry, and the way in which building users can be helped to use buildings in an environmentally positive manner.

In this opening chapter, we will consider a range of initiatives which have been developed and implemented at the European level. They provide a useful context within which it is possible to appreciate the importance of CIC Start Online as a mechanism to demonstrate cutting edge, yet achievable and accessible, ways in which the environmental impact of the built environment can be significantly improved.

## 2 A European Context

The European Community has developed its responses to energy scarcity and climate change through a series of treaties and strategic plans. Each is of interest in that they at once help us to trace the development of knowledge, and help us to place the importance of applied work (as seen through CIC Start) within a wider context.

Recent studies [1] have identified that certain barriers need to be overcome in order to facilitate significant environmental improvements in buildings, including financial, institutional, awareness and cost/benefit calculation and separation. To some extent, these can be regarded as essential components of sustainable development, and align with the generally accepted ‘pillars’, being economic growth, environmental protection and social equality (UN [2], paragraph 48). These can be readily recognised through specific studies within CIC Start, including studies of institutional awareness, human behaviour and the impact of building standards on environmental performance.

It is perhaps worth mentioning that a major aspect of energy use is that of user behaviour. This topic has been studied extensively in recent years [3, 4], yet often tends to find itself sidelined within European strategies. Whilst the reasons for this might be obvious (e.g. lack of directly attributable economic benefit, or difficulties in addressing the subject), the CIC Start project was laudable in that a series of studies tackled the area directly. These include a detailed study of the effects of occupant behaviour on energy use (as opposed to theoretically predicted levels) within Scotland’s first Passivehaus homes (Fig. 1) [5], and a study of the extent to which occupant behaviour can be altered through the effective use of environmental communication strategies [6].



**Fig. 1** Scotland's first certified Passivehaus development © Professor Gokay Deveci

## ***2.1 SET Plan***

The European strategic energy technology (SET) plan was launched in 2010, and brings together a series of strands, which collectively aim to address European energy and carbon reduction targets. The plan recognises that in order to meet targets for reductions in energy use, and to address the future challenges of climate change, that the community needs to recognise the importance of both policy and technology. The plan extends the already heavy involvement of industry in European research and development (already very apparent in Framework 7), with the intention of accelerating the uptake of innovative technological solutions within practice.

As mentioned, the SET plan contains a series of 11 initiatives and groupings, dealing with aspects of energy use, energy production carbon capture and the development of renewable energy sources. Of particular relevance to CIC Start is the 'Smart Cities' initiative, which aims to improve energy efficiency in our major cities through the development and adoption of new technologies. Enshrined within the SET Plan, the Smart Cities initiative aims to step up the deployment of renewable energy in large cities and to exceed targets set in EU energy and climate change policy. Major challenges facing European cities in the coming years, and as enshrined within European and national policies, include a need to recognise challenges which will emerge from scarcity of energy sources, natural resources (including water), need for sustainable transport systems, and often radical solutions to waste management and recycling. Indeed, other associated programmes including the CIVITAS initiative and Interreg have supported innovative and ground breaking work in the fields of sustainable transport and sustainable energy use. Smart cities projects awarded within the European research 'framework' have

dealt with technological and planning issues, and have tended to concentrate on applied (city led) research.

The smart cities initiative has included the establishment of a stakeholder platform, which itself deals with a range of issues, supported by finance and 'roadmap' steering groups:

- Energy efficiency and buildings
- Energy supply and networks
- Mobility and transport.

As Europe becomes increasingly urbanised (Fig. 2), in terms of demographic location, the importance of cities and the manner in which they are able to respond to climate change, to some extent dictates whether efficiency targets can be met. Strategic sustainable planning of our cities requires an approach to urban planning which is at once innovative, yet also in full recognition of lessons which may be learned by working across geographical and political boundaries. As cities in Europe begin to address the challenges of peak oil, the manner in which European, national and local policies reflect and respond to the challenges will be crucial.



**Fig. 2** Successful integrated urban design in Copenhagen © Professor Richard Laing

## ***2.2 European to National to Local***

Of course, Scotland itself has been one of the most urbanised countries in Europe since the 1800s, with two-thirds of the current population living in the five major cities and a heavy concentration in the central belt ([7], Sect. 2.4.1). Therefore, the implications of EU agendas for smarter cities are of particular relevance to Scotland. The announcement of Glasgow as the first of the UK ‘smart cities’ will support the demonstration of technology aimed at improving efficiencies, as well as theoretically helping to reduce emissions and fossil fuel use.

Aspects which were dealt with specifically within CIC Start include responses at both city and building scales. The project considered in some depth the complex relationships between legislation, community engagement and citizen action and responsibility. This included, for example, efforts undertaken by Aberdeen City Council to deal with alternative transport methods, and the use of digital communication to empower households and individuals across the city [8]. In turn, this connects well with initiatives across the North Sea Region, including attempts to address the issues of sustainable urban transport (<http://www.care-north.eu>) and low carbon buildings (<http://www.buildwithcare.eu>). What perhaps sets such initiatives apart from many research and development projects is the central involvement and leadership of local authorities. This enables transnational debate and transfer of best practice, including the development of environmental policies (related, in the case of Build with CaRe to issues of environmental issues, economics, technology and human-centred design). Many of these issues were addressed directly through the series of CIC Start webcasts [9] (Fig. 3).

At the national level, it is also important to address building standards, and the manner in which they can be used to drive change [10], including the application of technological solutions including air tightness [11] and the suggested implementation of sustainability labelling [12]. Dodds [13] noted the importance of existing buildings in the drive to meet carbon emission targets, and specifically identified that nondomestic buildings could be targeted. One presumes that this must take place alongside economic incentives, or perhaps be driven by publicly owned buildings in the first instance.

## **3 Building Specific Initiatives and Drivers**

Other initiatives which are having a direct bearing on the topics covered within CIC Start have emerged through industry led and industry supported activities. For example, the European Construction Technology Platform (ECTP) gave rise directly to the energy efficient buildings initiative, in addition to giving direction to wider European R&D expenditure.

The energy efficient buildings initiative (<http://www.e2b-ei.eu>) was founded in 2008, and aims to address the energy use and carbon emissions emanating from



**Fig. 3** Sustainable urban mobility integrated in the urban fabric (example from Bremen in association with CARE North/Interreg IVB) Image © Richard Laing

construction. The initiative is directly managing €2bn of R&D expenditure (between 2009 and 2019), with specific calls dealing with material, technology and both new and existing (heritage) buildings. Given that there have been a plethora of energy-related plans across the community, the E2B initiative serves a useful purpose as a focus for built environment activity. Associated with the E2Bi, of course, is the application of building and energy performance standards.

The European Energy Performance of Buildings Directive [14] has provided the basis for community wide responses to energy use within the built environment. The implications for member states extend to the energy performance of both new and existing buildings, and the standardisation of the manner in which energy performance is measured and certified. As is noted below, though, a major challenge lies in addressing the performance of existing buildings. The energy performance of buildings directive (EPBD) set out standards within the context of building refurbishment, along with direction for the assessment of efficiency in installed equipment (for example, water heating).

The EPBD was effectively ‘recast’ in 2010, to address a number of specific issues [15], with particular emphasis on a need for the EC to move towards zero energy or nearly zero energy buildings. The revision also greatly increased the requirement to assess the performance of existing buildings undergoing ‘major’ refurbishment, regardless of their size. Within the UK, there is currently a requirement to deliver zero carbon homes from 2016. Scotland currently has ambitious and specific targets, including an aspiration for all new buildings to be zero carbon by 2016/17 ([16], Sect. 2.3).

## 4 Building Typologies

The vast majority of buildings and infrastructure which will be in place of 20 years time have already been built, and thus the manner in which we deal with them in relation to energy efficiency at local, city and regional levels is of paramount concern. Particular challenges relate to the balance between spatial planning, energy consumption and behaviour and the development of new and extended urban centres. With such challenges comes a need to also address the appropriate retro-fitting of buildings. This has been recognised within international and national policies and agendas, yet the routes which can be followed by building owners are often not clear. Recent examples of innovative refurbishment projects have demonstrated how modern technology can be used to upgrade the environmental performance of buildings in such a way that is harmonious with the need to respect the built heritage [17].

CIC Start has addressed the issue of sustainable refurbishment through a series of key feasibility studies, many of which are outlined in the following chapters. What is apparent is that there are clear issues to be addressed regarding the relationships between financing [18], design, monitoring [19] and occupancy [20], which may be specific to older properties, and which require distinct solution when compared to new build.

An important feature of the initiatives described, and of the activities within CIC Start, is the importance of the existing building stock. Although figures vary across Europe as a whole, recent estimates have suggested that around 90 % of the UK built environment was constructed prior to 1990 [1], and under building regulations requiring far less attention to insulation, carbon emissions and energy use. Indeed, more than 50 % of buildings currently standing in the UK were constructed prior to 1960, which also opens a natural discussion regarding changing practices in terms of materials use and the availability of appropriate craftsmanship.

## 5 Summary and Key Points

This chapter provides an overview of some of the international drivers for change within the built environment. Although these can often appear to exist at an intangible level, their effect in terms of driving investment in sustainable technology has been significant.

CIC Start Online has successfully demonstrated how many of the concepts, including the innovative use of design, materials, emerging technology and a knowledge of energy use, can be applied at the project level. Indeed, the knowledge base created can be regarded as a basis from which wider adoption of visionary ideas can begin within the mainstream construction industry.

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