REVIEWING THE SUSTAINABILITY OF EXISTING HEALTHCARE FACILITIES

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The National Health Services (NHS) is currently undertaking its largest hospital building programme with £7 billion worth of major hospital projects in the pipeline. This is happening at a time when global warming, climate change and environmental pollution have become major considerations during the design process. The Pan American Health Organization (PAHO) reported that hospitals tend to comprise the key characteristics of a hotel, a warehouse and a factory all at the same time, which makes their energy consumption extremely high, although the energy consumption does vary considerably from one facility to another. There are standards and guidelines for designing new healthcare facilities such as Leadership in Energy and Environmental Design (LEED) and the Green Guide to Health Construction (GGHC). These standards do not apply to existing healthcare facilities. Comparing today's NHS building stock, it wont be incorrect to say that, most of the facilities used by NHS are built in 20th century operating in 21st century. This is a major problem associated with theses facilities, it is reported that 30% of energy consumed by these facilities is wasted. This work is based on a literature review which explores the government actions, policies, and available standards for healthcare facilities.

Keywords: energy, healthcare facilities, standards, sustainable development.

INTRODUCTION

The Department of Health (DH) is the overall policymaking body and responsible for the delivery of healthcare services in England (Tudor, 2007). The NHS is the largest public sector organisation and one of the largest property portfolios compromising many services related to healthcare. Hospitals are substantial users of energy: in England alone the healthcare sector is responsible for about 3.47 million tonnes of carbon dioxide emission a year and estimates shows that admissions to hospital linked to air pollution cost the NHS between £17-60 million per annum (DH 2005). Because hospitals place such demands on community resources, they are natural candidates for sustainable design. Although steps have been taken by government and health authorities towards the better development of new hospitals and healthcare facility (HCF), the literature reveals that there has been insufficient consideration given towards the development of existing healthcare facilities (HCFs). With the emergence of new sustainability assessment tools such as LEED and BREEAM, there is a growing need to examine the options for improving existing healthcare facilities through strategic problem-solving of the major issues, such as energy consumption. The objectives of the research reported here are to: outline the case for a new way of assessing existing healthcare facilities and identifies key areas for consideration; investigate the root causes of the current poor progress and drivers in terms of the

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Sheth, A, Price, A D F, Glass, J and Achour, N (2008) Reviewing the sustainability of existing healthcare facilities. *In:* Dainty, A (Ed) *Procs 24th Annual ARCOM Conference,* 1-3 September 2008, Cardiff, UK, Association of Researchers in Construction Management, 1193-1202.

practical application of the standards and sustainable development; and discuss the quality and prevailing trends in the healthcare facilities within the concept of tools and standards for sustainability and to establish relationship between standards and quality of healthcare facilities.

The paper is structured as follows; the next section provides background information on UK healthcare, context and drivers, outlines the strategy drivers for DH. Then follows the issues related to healthcare facilities and construction industry, analysed and presented from the study initiated by others in the same area. A brief section on energy efficiency targets and climate change is discussed. The final section discusses the quality of existing healthcare facilities followed by conclusion and area for further research.

UK HEALTHCARE: CONTEXT AND DRIVERS

At both global and national levels, several efforts have been made to marry the healthcare and environmental challenges, but progress remains relatively slow. This work reviews a large body of knowledge to develop and promote the concept. It also examines and highlights the drivers and suggests possible solutions. The final tasks involve a detailed review and analysis of the UK Government's approach to achieve the goal of a sustainable development (SD). Since its formation in 1948 significant sums money have been invested in the development of healthcare facilities and the NHS estate. Until the announcement of Private Finance Initiative (PFI) in 1992, with the aim of achieving closer partnership between the public and private sectors, the NHS was solely responsible for such development (Allen, 2001). In more recent times the Department of Health Estates and Facilities Directorate (DHEFD) has advised, guided and supported the NHS towards a sustainable approach in the procurement and management of its estates, facilities and services, by providing training, best practice advice and guidance documents, software tools, research and development, and engagement with the private sector partners. Key initiatives taken by the DHEFD (DH, 2007) are:

- partnership with The Carbon Trust to promote energy efficiency in NHS facilities;
- work with the Waste and Resources Action Programme (WRAP) to promote the use of recycled content of materials and reduce waste; and
- a £100m energy and sustainability capital fund to assist the NHS towards achieving energy/carbon efficiency targets by 2010.

To provide a broader context for these moves in the UK, the sustainable development strategy of the Department of Environment, Food and Rural Affairs sets down a set of clear strategic drivers for development (DEFRA, 2005), which have been interpreted by the DH into five principles, supported by four key priority areas, as shown in Figure 1.

All central Government Departments have had to sign up for a Carbon Trust energy audit to identify cost effective savings and develop the action plans needed to deliver them (DEFRA, 2006). This is to establish clear terms of reference to facilitate and promote sustainable operations across the government estate. Furthermore, the environmental policy adopted by NHS has emphasised the need to introduce environmental management systems (NHS, 2002). These policies outline the need for Trusts to integrate and take into account environmental strategy and environmental impacts in their estate strategies. Policies are developed to introduce a requirement for environmental impact to be taken into account. The DH-sustainable development

high-level group is taking forward the development of sustainable development action plan (SDAP) with its Non-Departmental Public Bodies (NDPB) and Special Health Authorities (SpHA). Hence, there are number of initiatives at a higher and strategic level in healthcare; specific sustainability issues relevant to individual healthcare facilities are discussed next.

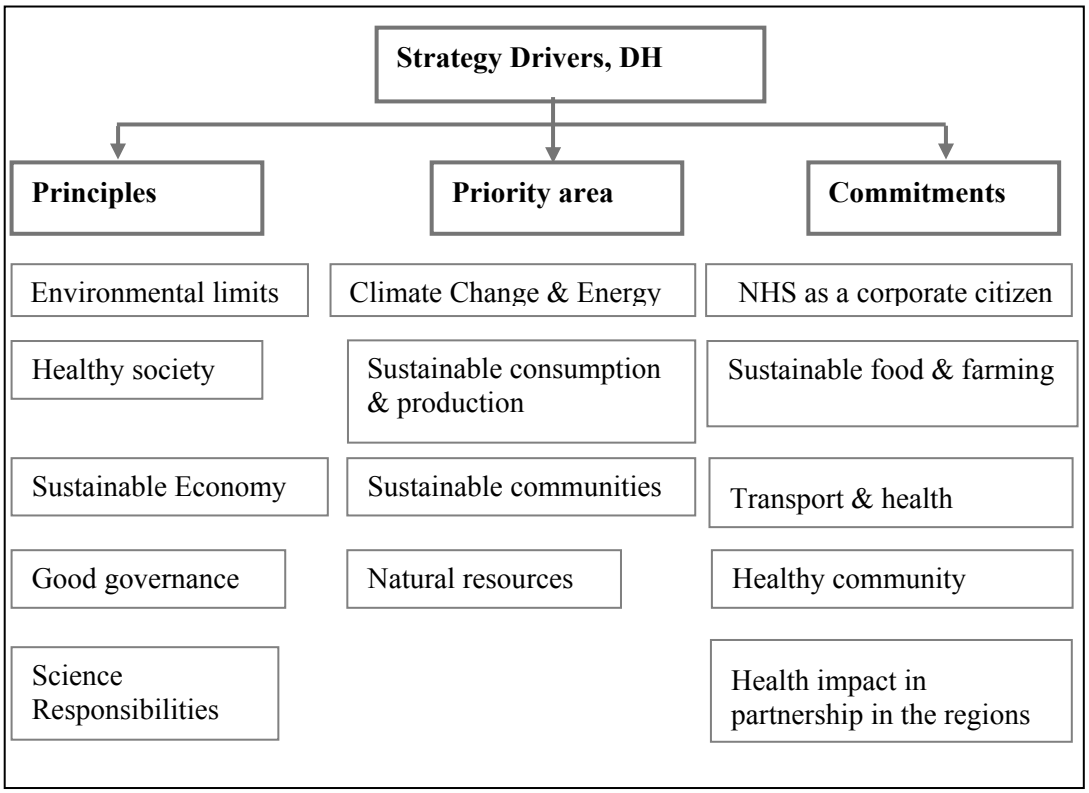


Figure 1: Strategy drivers for the Department of Health (DoH, 2007).

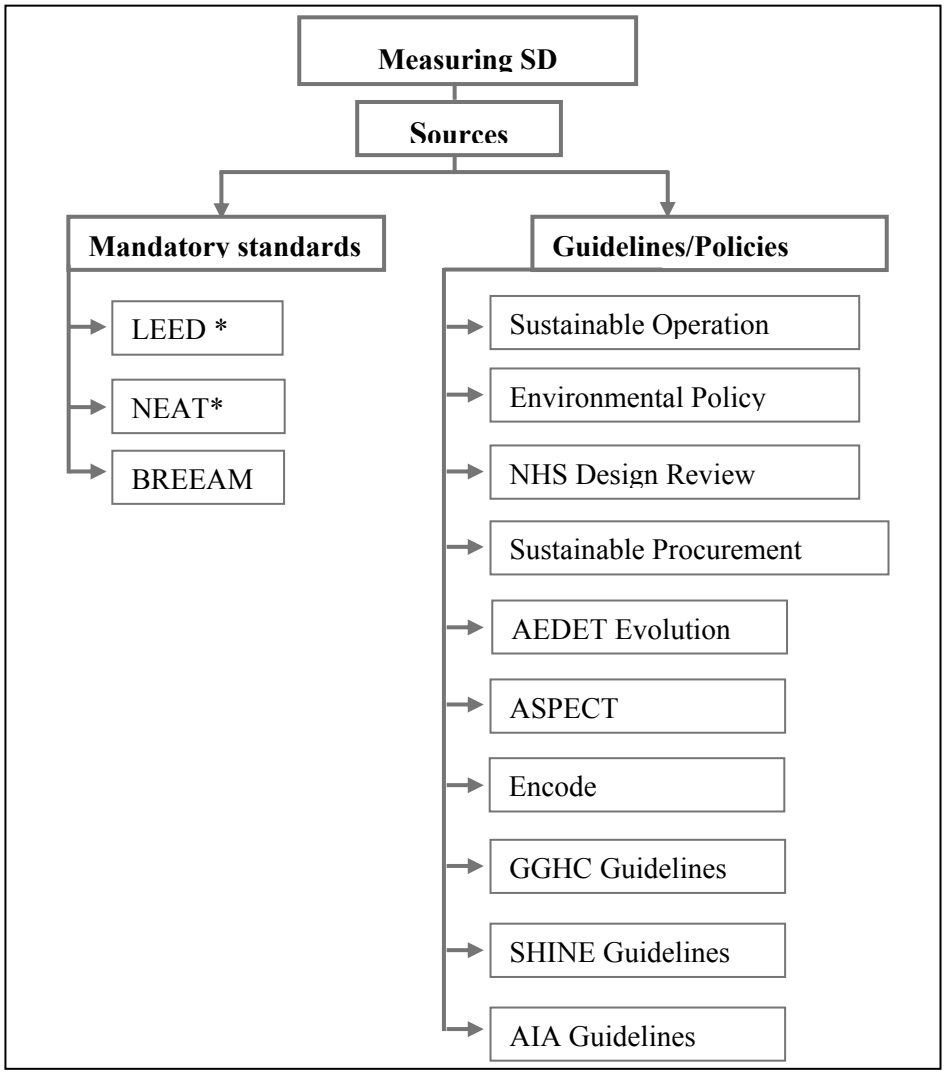
SUSTAINABILITY ISSUES IN HEALTHCARE FACILITIES AND CONSTRUCTION INDUSTRY

There have been decades of under-investment: the NHS is a 1940s system operating in a 21st century, which is one of the main causes for unsustainable; energy inefficient facilities. Only 15 percent of the existing stock of hospitals will be built in this decade of the 21st century and one third of the buildings used by the NHS today was built before even formation of the NHS (NHS, 2002). Of the 2.5 million healthcare patients afflicted each year with hospital-acquired infection, roughly six percent of these are attributed to design/construction and operation/maintenance practices (Michael, 2006). Many existing healthcare facilities are: heavily dependent on artificial systems, such as lighting, ventilation and interior environments; low in thermal mass and consume nearly twice the annual energy of an average commercial office building (as they heat up or cool down too rapidly). This is a major problem given the high number of existing healthcare facilities, with reports suggesting that 30% of energy consumed by these facilities is wasted. Also, the general perception of literature agrees that the construction of healthcare facilities seems different and more complex and should be sustainable (Akintoye, 2005). It is therefore, understandable that existing healthcare facilities could deliver significant improvements in the estate's sustainability performance – but what exactly is meant by sustainable building?

A relevant definition is offered by the Canadian Office of the Federal Environmental Executive (OFEE), “Green or sustainable building is the practice of designing, constructing, operating, maintaining, and removing buildings in ways that conserve natural resources and reduce pollution” and/or “Buildings that are safe, healthy and productive for their users and owners, make a positive contribution to their local surroundings, and have a minimal impact on the local and global environment both today and for generations to come” (SHINE, 2008).

In the UK, a new way of planning healthcare facilities was indicated by Rt. Hon Alan Milburn, MP, Secretary for State of Health during the “Building a Better Patient Environment” (NHS, 2004):

> *"To ensure that good design is embedded within the NHS hospital building programme I can say that design proposals in future will be reviewed by a panel, led by NHS Estates and The Prince’s Foundation, CABE and others, at the earliest stages of the procurement process before a preferred bidder is chosen".*



* Standards for healthcare facilities are under development

Figure 2: Sources of guidance and standards for assessing HCFs

Therefore, a range of tools and guidance documents have emerged which attempt to help design and project teams to deliver better healthcare facilities, by perhaps offering design guidelines, standards or environmental assessment methods. Figure 2 shows a range of relevant sustainability guidance documents, standards and assessment methodologies that are applicable to healthcare facilities. Most of these are financed, sponsored by DH or NHS Estates.

Many of the available tools focus on some aspects of sustainable development, but not all. Some are "Microsoft Excel" based, “yes or no” type self assessments, where the assessor requires some, but not necessarily a detailed knowledge of environmental issues or measures. One of the leading, popular methodologies is Leadership in Energy and Environmental Design (LEED). However, of the approximately 1,800 registered projects in the LEED system in 2004, only 2% of these projects were in the healthcare industry (Howard 2007). In addition, LEED-NC is focused on new construction, and there is not an equivalent for existing buildings, hence projects teams will need to develop their own ‘version of LEED-NC to cope with this.

Furthermore, Manoliadis et al (2006) conducted a survey to identify the important drivers in sustainable construction projects. They found that the most important driver was ‘Energy & Carbon (CO2) emissions’, followed by fourteen other drivers. This indicates the possible range of aspects that could be taken into account in a sustainability assessment of existing healthcare facilities, as shown in Figure 3.

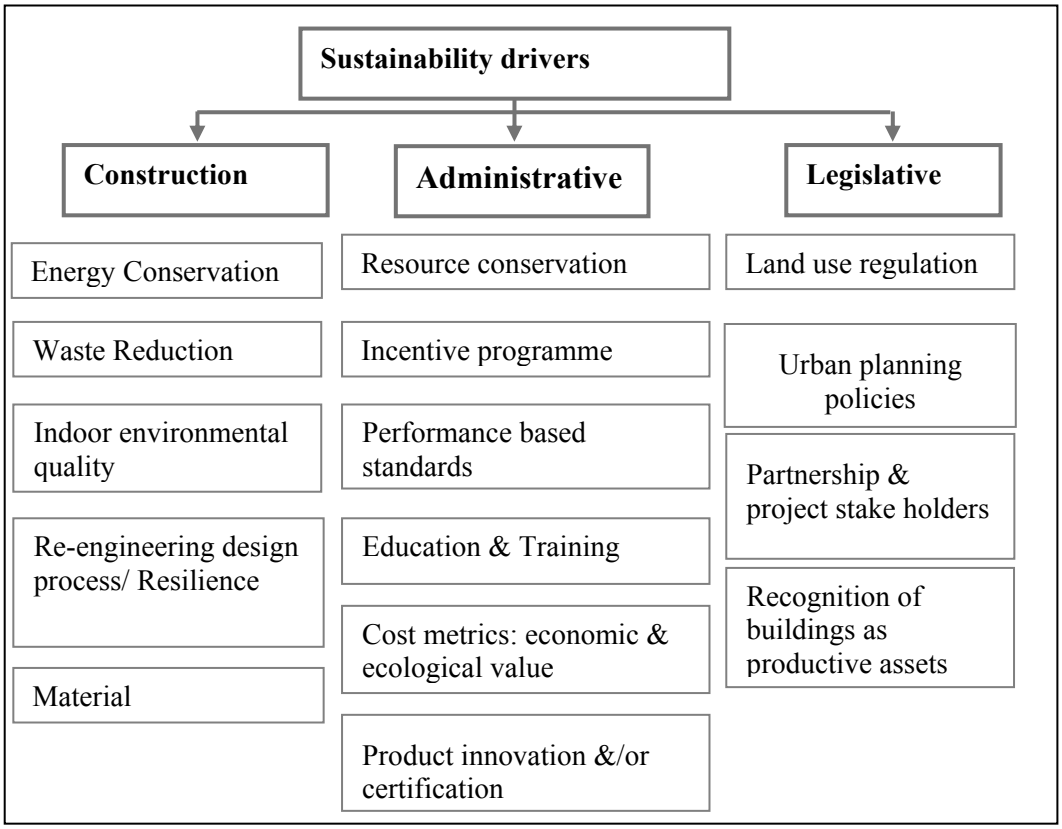


Figure 3: Sustainability drivers (after Manoliades et al., 2006)

Despite high-level government commitment to sustainable development, agreements and targets for Greening the Government Estate (GGE), there is much less evidence of sustainable development in requirements for publicly-funded projects than might be

expected (Flood 2003). So, despite massive investment, high level strategic, sustainable development directions and specific "green" building tools being available, the NHS estate and healthcare facilities are not changing significantly and more importantly an ageing infrastructure dominates the UK's healthcare building stock. The government has set a reasonably clear agenda in relation to the sustainable development but there is a lack of clarity as to how this affects healthcare facilities, particularly existing buildings. Furthermore, many of the available standards and guidelines such as LEED are under development, and yet to be tried and tested for different types of scenario, atmosphere and conditions. It is said that, the BREEAM system is used extensively for other building types and tailored for healthcare facilities is on the way.

Many studies have been undertaken and provide a review of UK construction contractors' engagement with the concept of sustainability and gauge their response to the issues being raised. Thomson et al (1998) suggested that the healthcare buildings design need to be flexible in order to facilitate future changes without significant structural or fabric alternation. Adentunji et al (2006) conducted a review using questionnaire to identify the overall responsibility and the relation to government codes, policies and standards for sustainable construction issues within the organisation. The findings of the study, as summarised below in the table 1, indicated the drivers and environmental management practices as major concern for sustainable development. Where level of importance from 1 to 5, where 1 = strongly disagree and 5 = strongly agree.

Table 1: Drivers, Barriers, EcMP and EnMP for sustainability.

	Mean	**A (<£100m turnover)**	**B (£100m to £500m turnover)**	**C (> £500m turnover)**
1. Drivers; Government and regulation	4.20	4.00	4.09	4.50
2. Barriers; Lack of awareness and information regarding the available tools	3.69	3.29	4.27	3.50
3. Economic management practices (EcMP); Codes, Policies and Standards	2.18	1.57	1.94	3.04
4. Environmental management practices (EnMP); Codes, policies and standards	4.63	4.24	4.64	5

In the table 1; Row '1' shows the main drivers for implementing sustainable construction; analysis of the possible barriers for implementing sustainability is presented in row '2'. EcMP and EnMP are presented in row '3' and '4' respectively.

CLIMATE CHANGE

New report from the 'government' and 'regulation' New Economic Foundation (NEFF) states that the NHS, as one of the biggest and most resource-hungry public sector institutions in the world, must upgrade itself in relation to the health impacts of global warming and act urgently to reduce its significant carbon footprint by more rigorous control of emissions and pollution (NEF, 2007). Given that the NHS has an aged/existing building stock this is not easily achieved but there are many opportunities being provided through the current new build programme. Considering

the NHS carbon footprint and extent of its building stock, the UK Government has initiated a “Climate Change Programme”, to tackle pollution, improve the eco-logical footprint and thus reduce the NHS's contribution to climate change. As part of the introduction of the “Climate Change Programme”, two sets of mandatory targets have been set for NHS bodies in England, these are: to reduce the level of primary energy consumption during the first decade of the 21st century; by 15 per cent or 0.15 MtC (million tonnes carbon); to achieve 35-55 GJ/100 cu.m. energy efficiency performance with in the healthcare sector for all new capital developments and major redevelopments/renovations or refurbishments; and that all existing facilities built in 20th century should achieve a target of 55-65 Gj/100 cu.m. (Denham, 2001). NEF reported that despite a plethora targets for reducing emissions and energy use, there is a need for detailed strategies to address climate change in an integrated way across the NHS – with ambition to match the scale of the problem, considering the NHS's overall footprint at macro level. Findings from the NEF research reveals that better environment design for NHS could not only cut energy costs by a quarter but could also increase the productivity of the NHS’s 1.3 million-strong workforce by between 6 and 16 per cent. Although there have been some improvements in energy and carbon efficiency, the expanding healthcare estate, increasing number of patients being treated, the levels of service provision and greater use of technologies have resulted in increased overall energy consumption (DH/HPA, 2008) which need to be addressed in order to make healthcare facilities and the NHS estate more sustainable.

QUALITY OF EXISTING HEALTHCARE

Since the introduction of PFI in 1992, there has been lot of development. The survey was conducted by National Audit Office in 2003 to gather information about the design and built quality of the healthcare facilities. Figure 4 & 5 are based on the outcomes of the survey.

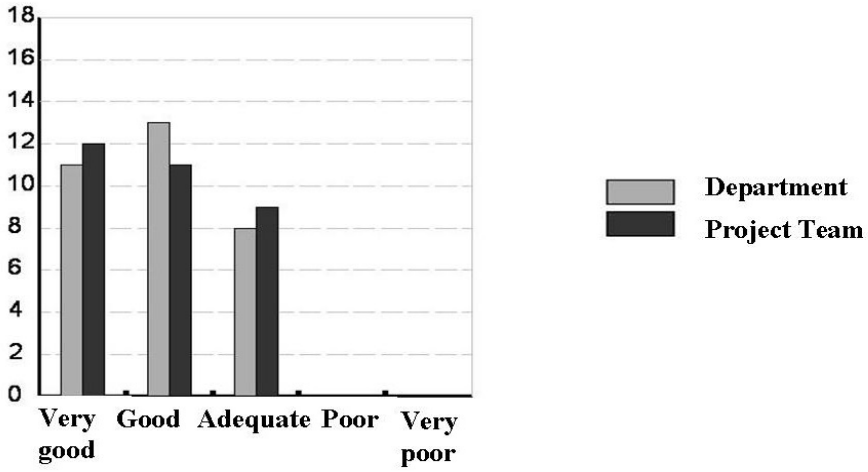


Figure 4: Rating of Design Quality

Rating build quality

Figure 5 (Source: National Audit Office) shows that all the respondents rated a design and construction quality adequate or better.

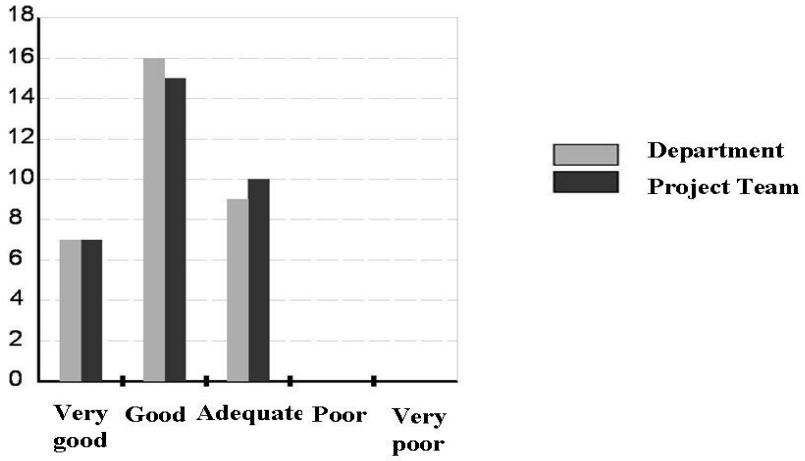


Figure 5: Rating of build quality

Although design quality and built quality respectively is reported in Figures 4 and 5 (Bounn, 2003) as very good and good; these scheme are not developed based on the same background and standards of sustainable healthcare facilities and this give the freedom to project managers to specify there project as a good or very good. There are no specific rules, definition and standards to justify the project as a good or very good developed by the respected body. These facilities are not following any specific document, format and there is no data available related to energy consumption and other relevant information to carry out further research.

CONCLUSIONS

The size and nature of the NHS estate has resulted in very high energy consumption, a large carbon footprint and a significant contribution to climate change. Although there is a major ongoing new build programme, the estate comprises many old healthcare facilities and different solutions may well be needed depending upon the type of facility. Several sustainability assessment tools, guidelines exist but many need to be further developed to suit existing healthcare facilities and need to be mandatory , for example NHS Design Review Process, health building notes (HBN), etc. There is also a need to revisit existing planning, design and construction processes and applications of Environmental Management Systems (EMS). This paper has raised need to outline the case for the better integration of existing assessment tools when dealing with healthcare facilities. An integrated holistic approach towards compliance with legislation and regulation is thus needed to significantly reduce the NHS's carbon footprint and energy consumption. Considering the complexity and number of factors that need to be considered, no single individual has complete knowledge and a team approach is required. Therefore, integrated teamwork processes and holistic approaches have an important role in every stage of planning, design and assessment. This paper has mainly considered carbon and energy, however, these should not be considered in isolation and many other issues need to be considered in relation to sustainable healthcare infrastructure, for example:

4. Broader environment impact and equity;
5. Patient and public safety;
6. Waste management;
7. Broader social impacts and equity; and
8. Economic impact on individuals and local communities.

There are multiple stakeholders involved in the planning, design and operation of healthcare facilities, all of whom will have different opinions regarding the relative importance of the factors that contribute to sustainability of healthcare facilities. Methods thus need to be developed to achieve a consensus around the definitions, factors and methods of assessing the sustainability of healthcare facilities.

Based on the above, the next step in this research will be to develop and test a framework for assessing and improving the sustainability of existing healthcare facilities which provides better integration of the available, tools, guidelines and standards together under the context of sustainable development, with a particular focus on energy and carbon dioxide emissions. There is also a need to take account of facility adaptability and resilience of healthcare facilities to the physical impacts of climate change and what effects could various climate change scenarios have on the performance of healthcare facilities in relation to patient safety, recovery and energy consumption.

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