

State of the Art Report

# Low Carbon Buildings in the Healthcare Sector



## Preface

This report has been prepared to disseminate some of the initial findings of the LCB-HEALTHCARE project: a Public Procurement Network sponsored by the European Lead Market Initiative.

The overall aim of LCB-HEALTHCARE is to share experience and information on best practice procurement, lead market innovation methodologies and case studies related to the design, construction and refurbishment of low carbon buildings in the healthcare sector. The project consortium comprises national partners from England, Netherlands, Norway and Poland and a pan-European network (the European Health Property Network). It is coordinated by the UK Department for Business, Innovation and Skills that is leading a pioneering national programme to help the public sector better meet its policy goals through new approaches to procurement of innovative products & services.

The report commences with a contextual overview of the European healthcare infrastructure, which highlights the complexity and diversity across Europe and provides an indicator of the scale of the sector's carbon footprint. It then highlights the regulatory pressures that will be applied on EU Members States over the coming decade to improve the energy performance of buildings and reduce their contribution to CO<sub>2</sub> and other greenhouse gas emissions.

A selection of good practice examples from Europe then follows. We are grateful for the assistance of a number of contributors that provided insights on the state-of-the-art in other European countries; particularly Health Care Without Harm (HCWH) Europe, Bund Umwelt Naturschutz Deutschland (Germany), Foundation TEM (Sweden), Health Facilities Scotland, Prof. Arch. Simona Ganassi Agger (Italy), Stockholm County Council (Sweden) and the Vienna Hospital Association (Austria).

Finally, we would like to thank those stakeholders who completed the online survey and provided their collective feedback on the relative importance of the main barriers to innovation.

The LCB-HEALTHCARE Consortium

**April 2011**

Feedback on this report may be sent to [info@lowcarbon-healthcare.eu](mailto:info@lowcarbon-healthcare.eu) or by adding comments on the related Blog at [www.lowcarbon-healthcare.eu](http://www.lowcarbon-healthcare.eu)

The views expressed in this report are those of the authors and do not necessarily reflect the policies of the European Commission. Neither the authors nor the European Commission is responsible for any use that might be made of the information in this report.



## Index

### Executive Summary

1. European Healthcare Facilities
  - 1.1 Diversity and complexity of healthcare systems
  - 1.2 Trends in healthcare infrastructure and facilities
  - 1.3 Carbon footprint of the European healthcare sector
2. So what is happening?
  - 2.1 Some examples from European countries
  - 2.2 European initiatives
3. Barriers to Low Carbon Innovation

### Appendix: Survey Results



## Executive Summary



Europe needs to meet very challenging CO<sub>2</sub> reduction targets over the next decade and the healthcare buildings that are built and refurbished in the coming years will determine their carbon legacy for the future. The Low Carbon Buildings Healthcare project (LCB-HEALTHCARE) arose from the recognition that healthcare infrastructure is a major contributor to CO<sub>2</sub> emissions and the physical infrastructure of healthcare systems has a vital role to play in supporting the drive to achieve efficiency in healthcare.

When we set out on this project, anecdotal evidence indicated that healthcare building and renovation projects generally start with good intentions in terms of their carbon footprint and energy efficiency. But final

results often fall short of the original ambitions and traditional procurement practices are not delivering fast enough on carbon reduction. The LCB-HEALTHCARE team has begun to uncover the barriers to more successful delivery of low carbon solutions and initiate stakeholder debate on how these can be addressed. The study found excellent but isolated examples of good low carbon policy and operational initiatives in several EU countries, and we are pleased to be able to highlight some examples of projects that have shown what is possible through the adoption of lower carbon solutions and the use of innovation procurement methods. However, our recent survey of 100 European stakeholders has revealed some interesting insights on the very real barriers to low carbon innovation and

### Summary of main findings

The carbon footprint of the European healthcare sector is at least 5% of total EU emissions; similar to that from its international aviation and shipping activities.

Innovation in design, construction and renovation practice is urgently needed to reduce this footprint and create the low carbon, sustainable, patient-centric healthcare service models of the future.

Surprisingly, economic viability and operational risk were not regarded by stakeholders as the critical barriers to innovation. The key problem appears to be that low carbon policies have not yet influenced wholesale changes in procurement culture. In particular there was a lack of low carbon innovation leadership from both the healthcare sector and the design & construction supply chain.

Worryingly, there are strong indications that the European debt crisis and associated public sector budget cuts are inhibiting the policy and fiscal interventions that will be needed to overcome the procurement barriers.

adoption of low carbon technologies in this and other sectors. The consensus is that current procurement practice will not be effective in reducing this footprint in line with EU policy due to a number of barriers. These findings appear to validate the LCB-HEALTHCARE project's focus on procurement-related barriers and the need for more demand-side interventions to create the market pull for innovative low carbon solutions. The main findings of our work so far are summarised above.

These findings set the scene for our future work. Through the pilot projects in the four participating countries we will continue to explore both the barriers and means to overcome them, with the aim of sharing the lessons we have learnt and making

recommendations on the measures that healthcare agencies, managers and procurement professionals can take to buy better, low carbon building solutions.

We encourage you to join in the debate on how we can work together to help the healthcare sector be more innovative in procuring low carbon solutions and thus make a significant contribution to the EU Energy 2020 Strategy.

Further information on the LCB-HEALTHCARE project, the European Lead Market Initiative and the stakeholder forum can be found at [www.lowcarbon-healthcare.eu](http://www.lowcarbon-healthcare.eu)

## 1. European Healthcare Infrastructure

### 1.1 Diversity and complexity of healthcare systems

#### The foundational principles of European healthcare

The nature and scope of Europe's healthcare systems depend on two main factors: their financing mechanisms, and the historical and cultural context in which they have developed. The interplay of these factors has a determining influence on many aspects of healthcare such as the relative balance between primary, secondary, and community healthcare provision, the power relations between policy makers, clinicians, planners and managers, the level of devolved responsibility for priority setting and decision making, and many other organisational matters.

In recent years, and in very broad terms, the financing of European healthcare has been achieved through two contrasting models. The Beveridge model, in use in the UK and in most Nordic countries, relies on direct taxation at the level of central government, with the national healthcare budget redistributed to provider organisations at regional or local level. The Bismarck, or social insurance model, characterises healthcare funding in most other European countries. Bismarck-type funding typically involves a mix of payments to healthcare insurance companies from individual citizens, employers and local or central government, with differing balances between these payers in different parts of Europe. The insurance companies – which vary in nature from small, regionally-based companies to larger private corporations, and publicly-owned institutions – then negotiate services for their clients from the available range of healthcare providers.

Despite the different approaches to funding, there is significant congruence in the amount of GDP that Europe's nations spend (or aspire to spend) on healthcare provision. OECD statistics indicate that 20 countries fall within the range of 7-10% of GDP<sup>1</sup>. This

proportion of GDP naturally means that healthcare systems are large employers (often the largest in their respective countries), purchase huge quantities of supplies and services from the European and global supply chain, and are major owners of capital assets in the form of land, buildings, and equipment. Given the important role played by healthcare systems in the economies of Europe, it is no surprise that European healthcare policy makers and planners increasingly recognise the need to manage resources responsibly and to play a leading part in ensuring efficient, forward-looking public procurement.

Historical and cultural context also plays a part in the current configuration of the EU's healthcare systems. In recent decades, for example, the healthcare systems of some post-communist countries such as Poland, Hungary and the Czech Republic have had to adjust from central planning and provision of the Semashko system to either an insurance fund or central taxation model, with (in some cases, at least) increased autonomy for primary care practitioners and hospital organisations. The current nature of healthcare organisations is often underpinned by factors such as their origins in religious institutions, the development of professional associations, the influence of university research centres, and, to some extent, by national geography and climate.

Nonetheless, despite the apparent variation between different European healthcare systems it is clear that the international nature of medical education, coupled with cross-border research programmes and an increasingly mobile workforce, mean that healthcare systems are increasingly converging. This is particularly the case in terms of their understanding of the response required to meet future healthcare needs and the overarching principles of care. For example, nearly all European health ministries aim for equitable access to their healthcare systems, and recognise that universal

<sup>1</sup> Source: *Health at a Glance: Europe 2010*, OECD, 2010

coverage is a public good. Governments around Europe ensure that there is some provision of healthcare services – albeit sometimes quite basic – for the most vulnerable sections of their populations, including those who live in poverty or are unemployed. Most countries also organise healthcare such that primary care doctors act as gatekeepers to the rest of the system, referring patients to hospital-based care as necessary and controlling access to community and social care organisations.

### Healthcare system complexity

EU healthcare systems share a further common factor: a high degree of internal complexity. The range of services on offer – primary, secondary and tertiary care; mental health provision; community-based care of the elderly, people with dementia, the disabled and those with learning disabilities; and much more besides – is marked by an intricate set of relationships between public, not-for-profit and private healthcare providers on one side, and local, regional, and national commissioning organisations on the other. Into this mix we have to add the associations that represent clinicians, patients, and the pharmaceutical and medical device industries, as well as the suppliers of equipment, building materials, and construction expertise. The result of this highly complex and constantly shifting web of market forces is that the locus of decision making varies significantly across Europe. In some countries, for example, national governments closely determine the standards applied in acute hospital care; whereas in other states these functions have been largely devolved to regional health authorities or to municipalities with responsibility for just a few thousand people. Healthcare may be highly compartmentalised in some countries, with primary care physicians preserving an independent, gate-keeper role, while other regions have opted to encourage a more integrated approach that manages patient care pathways across the 'traditional' boundaries of community, primary and secondary care. Underlying the complexity of European healthcare

systems, however, is the need to respond to the pressures brought about through budgetary contraction, an ageing population, and the rise of chronic illness as the major challenge facing the healthcare sector.

Put simply: Europe's healthcare systems face a seemingly inexorable rise in demand, caused in the main by the diseases associated with old age and conditions associated with so-called 'lifestyle' factors. At the same time, medical knowledge and technology allow for an ever increasing range of interventions, often at great cost to healthcare providers, while Europe's citizens demand faster, better and higher quality care. The emphasis is therefore on greater productivity and efficiency, together with an emerging recognition that the locus of care should ideally shift from hospital to community services and the home.

There is an increasing recognition that the physical infrastructure of healthcare systems has a vital role to play in supporting the drive to achieve efficiency in healthcare. Buildings need to be planned to anticipate future changes in care models, and have to respond to new thinking about the management of patient flow and the use of mobile or remote technologies. An additional challenge for healthcare service managers arises from EU and national targets for CO<sub>2</sub> reduction, and governments recognise that all public sector organisations – including healthcare – have a responsibility to act as leaders in this area. In the face of rising demand and financial restrictions, healthcare organisations have to go further and faster, in finding innovative ways to reduce energy consumption, to ensure that the health estate becomes sustainably low (or zero) carbon, and to find more effective means to stimulate and manage the supply chain.

**All in all, the European Union has some 15,000 hospitals, which account for 25% to 60% of health expenditure depending on the country.**

**European Hospital and Healthcare Federation**

## 1.2 Trends in healthcare infrastructure and facilities

### Current trends

Healthcare infrastructure and facilities – healthcare capital assets – are not traditionally afforded the same interest and scrutiny as other aspects of healthcare services. New treatments and therapies are given high level publicity and attract large amounts of research funding, whereas the role of health buildings in enabling effective care and leading a reappraisal of public sector procurement generally has a lower profile. However, this is now gradually changing across Europe as planners, capital asset professionals and clinicians begin to accept that healthcare infrastructure has a key role in supporting new service models.

When credit was easily available and EU governments were able to make large scale investments, newly built or refurbished hospitals and clinics arose across the continent. From the mid-1990s to the near present there were significant investment projects for healthcare facilities in many countries, replacing or renewing an estate that dated back 60 or more years. England undertook a major programme of hospital construction, using the Private Finance Initiative (PFI) as the funding mechanism; in Italy, a number of regional health authorities embarked on a major reconstruction of the health estate; new acute and university teaching hospitals were built in Norway, Sweden, France, Germany and the Netherlands; publicly funded, but privately run, hospitals began to emerge in Finland, Spain and Germany; and the new EU Member States in central and east Europe started to have access to Structural Funds for health as well as increased interest from private sector construction companies.

Fiscal pressures are now much tighter, particularly in the public sector, and the consequences for planning and constructing health facilities are already being felt in terms of ever closer scrutiny of business plans and a renewed emphasis on alignment between service models and the built environment. Efficiency is the name of the game, in recognition of the need to do more with less.

Healthcare facility planners, designers, and constructors are responding through a variety of means. There is increased interest, for example, in reconfiguring the health estate to concentrate specialist services in a smaller number of expert centres, leaving a layer of general hospitals to deal with high volume, common treatments. A number of research centres are active in promoting the ideas of lifecycle investment planning, such that different parts of healthcare facilities can be adapted or recycled for other uses when the service model changes or when new technologies lead to home-based care for certain illnesses or conditions. Many policy makers now accept that hospital-centric models of healthcare have to change, and that there has to be renewed focus on bringing care closer to the patient – with inevitable consequences for the location, configuration and design of the health estate.

Patient safety has always been a major concern for health facility managers, but this issue has recently become even more important. As hospital patient populations become older and more likely to suffer from a range of co-morbidities, and with the rise of new and virulent healthcare acquired infections, all health facilities have to respond to these challenges, while maintaining an environment that is also suitable for family, carers, and staff.





To meet the challenges described above, some health facility planners and managers are turning to methodologies and practices imported or adapted from other sectors. Lean thinking, for example, has influenced the design of a number of major European hospital projects. The retail sector and other service industries have considerable expertise in managing the flow of people into and around their physical infrastructure, and in designing building to match their processes – and this knowledge is gradually being adopted in the healthcare sector.

These are the encouraging signs. However, it also remains true that too much thinking and practice in the design and construction of healthcare facilities remains rooted in the past. Procurement guidelines, embedded in static documents, do not always move quickly enough

to take full advantage of emerging technologies, new methods of construction, and emerging thinking about agile financing models. Many health facility administrations continue to build or refurbish their estate to match service models that are already a decade out of date. Minimum standards to build and refurbish are common rather than adoption of progressive standards that anticipate the energy and carbon costs of the future. The public sector does not appear to be doing enough to stimulate and encourage a vibrant, innovative private sector supply chain, and this is especially true in terms of the healthcare sector's response to Europe's CO<sub>2</sub> reduction targets. The remainder of this document examines the extent of the carbon challenge for healthcare facilities, and outlines some key features of current and emerging good practice in this field.

### 1.3 Carbon footprint of the European healthcare sector

As mentioned above, the typical European country spends nearly 10% of GDP on healthcare provision. This scale of economic activity, coupled with the relatively high energy intensity of healthcare operations, would suggest that the sector's contribution to total CO<sub>2</sub> emissions in Europe is significant.

The total emission of greenhouse gases (GHG), mostly CO<sub>2</sub>, from the EU27 Member States is nearly 5,000 million tonnes (2008)<sup>2</sup> but there is no published data on the carbon footprint of the European healthcare sector. Some countries are measuring and monitoring healthcare sector emissions but this is the exception rather than the rule. In England, for example, the healthcare sector accounts for some 5% of the country's total emissions<sup>3,4&5</sup>. This includes buildings, transport and the supply chain. Based on NHS England data it can be assumed that around 25% of the total emissions are related to energy for buildings.

In the absence of pan European data on healthcare sector emissions we can only estimate an indicative value for its carbon footprint. One simple way of obtaining an order-of-magnitude figure for the healthcare sector in the EU is to assume that the average is the same as for England (ie around 5% of national GHG emissions). This would give an indicative carbon footprint for Europe's healthcare sector of some 250 million tonnes per annum, a figure that is similar to the international aviation and maritime transport activities of the EU27 Member States. This seems to be a



reasonable 'ballpark' figure given that the equivalent for the more energy-intensive United States healthcare system has been estimated at 8% of total GHG emissions<sup>6</sup>.

The EU has adopted an ambitious vision to reduce its carbon footprint through the Energy 2020 Strategy and the Action Plan for Energy Efficiency. Regulations such as the Energy Performance of Buildings Directive (EPBD) will increasingly influence the design and refurbishment of buildings, which account for some 40% of overall energy consumption. A major transformation must therefore occur in the building sector during the coming years and the relatively high energy-intensive healthcare sector will come under increasing pressure to invest in lower carbon solutions.

<sup>2</sup> Greenhouse Gas Inventory Data – UN Framework Convention on Climate Change

<sup>3</sup> NHS England Carbon Footprint: GHG emissions 1990-2020 baseline emissions update

<sup>4</sup> Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland 1990-2005, AEA Technology (AEAT/ENV/R/2500 Draft Final), August 2007

<sup>5</sup> UK Climate Change Sustainable Development Indicator: 2007 Greenhouse Gas Emissions, Final Figures Statistical Release, Department of Energy and Climate Change, 3rd February 2009

<sup>6</sup> Chung Jeanette W; Meltzer David O: 'Estimate of the carbon footprint of the US Health Care sector', Journal of the American Medical Association, 2009;302(18) pp 1970-1972

## 2. So what is happening?

### 2.1 Some examples from European countries

Clearly the low carbon agenda is a major policy objective in Europe. The impact of this trend has not yet led to widespread concerted action in the healthcare sector but there are a growing number of examples of good practice leadership initiatives at both the policy and operational level. The following examples appear to be typical of current and emerging practice in Europe. It includes the position in the four countries that are participating in the LCB-HEALTHCARE project and gives selected examples from other countries that have been highlighted from our research or survey feedback. It is not intended to be a comprehensive overview of the position in all countries. The LCB-HEALTHCARE website ([www.lowcarbon-healthcare.eu](http://www.lowcarbon-healthcare.eu)) will provide ongoing links to good practice examples.

#### Austria

The Vienna Hospital Association (KAV) with 12 hospitals, 11 old people's homes and 32,000 staff is one of the biggest health institutions in Europe. It uses its procurement guidelines to phase out certain chemicals in medical products and sets sustainability criteria to reduce its environmental footprint. This is supported by an environmental protection department that was established in 1990. Every hospital and old people home within the KAV must prepare annual environmental reports about their activities and some are certified to EMAS and ISO14001. The KAV was also a partner in a pilot project at the Otto Wagner Spital hospital in Vienna that involved an interdisciplinary team of researchers supporting hospital practitioners to implement the concept of sustainable development (Sustainable Hospital to face the future). Another interesting example is the 'Vienna North hospital's charter on sustainability – quality criteria for planning and construction', which sets the guiding principles for a new 800 bed hospital that is being built in the north-east of Vienna

**No one knows the precise size of the health sector's global climate footprint, but we know that it is substantial.**

**World Health Organization**

Further south, the Styrian Hospital Association (KAGes), a group of 20 regional hospitals, is also quite active. It has recently published its climate action programme, which includes targets such as a 16% reduction in greenhouse gas emissions by 2020 (baseline 2005) and an increase in the share of renewable energy from 23% to 34%. This will focus on four areas; buildings, transport, procurement, and communication.

#### England

England and the Devolved Regions of the UK each have a National Health Service (NHS) that provides public healthcare to all residents. The NHS Carbon Reduction Strategy for England sets out the framework for the healthcare sector to make progress towards a low carbon society. This is driven by the requirements of the UK Climate Change Act, which has created a legally binding framework to work towards the 2050 target of reducing greenhouse gas emissions by 80% over the 1990 baseline. The new coalition Government in the UK has also recently confirmed the commitment of the previous administration that all new non-domestic buildings in the UK should be zero carbon by 2019 – with the public sector leading the way by achieving the target a year earlier.

Minimum standards are set by the Building Regulations and the next amendments, due to come into force in 2013, will be an important milestone towards the goal of zero carbon homes and non-domestic buildings, including healthcare premises. Additionally they should support the wider policy for retrofitting existing buildings to conserve energy. The UK Government recently published a report on how the construction sector can rise to the challenge of the low carbon agenda and the NHS Sustainable Development Unit (SDU) has launched a 'Route Map for Sustainable Health'. The NHS SDU is

aiming for a 10% cut in CO<sub>2</sub> emissions by 2015, from a 2007 baseline, the energy savings from which will also contribute to major constraints on the public sector budget. Each NHS Trust is required to provide data on its environmental performance through the central Estates Returns Information Collection (ERIC) system and this allows the NHS to monitor the overall performance of the sector. In order to stimulate adoption of best practice the Department of Health launched a £100 million sustainability fund in 2006/7 for investment in 'proven' solutions. Additionally, the Department has developed and adopted the Building Research Establishment's Environmental Assessment Method (BREEAM Healthcare) as policy for sustainable healthcare buildings with a requirement for new builds to achieve an 'Excellent' rating and refurbishments to achieve 'Very Good'.



The low carbon agenda is thus becoming more prominent in best practice awards. For example, Newham University Hospital in London was named the greenest in the UK at the annual 2010 Healthcare, Excellence and Leadership Awards. The hospital was one of the first public sector organisations to sign up to the RE:FIT Framework set up by the Mayor of London aimed at retrofitting buildings to save energy and cut carbon emissions through energy performance contracting. Another is Wythenshawe Hospital in Manchester, which won the overall first prize in the Guardian Newspaper's 2010 Public Services Awards for its far reaching carbon reduction strategy.

The Department of Health has also taken full advantage of the UK programme on innovation procurement that was established to help public sector organisations achieve their policy objectives. This programme uses a methodology known as 'Forward Commitment

Procurement' (FCP). An FCP pilot project with Rotherham NHS Foundation Trust<sup>7</sup> was initiated with pump priming funding from the Department of Health and facilitated through the 'Innovation for Sustainability' Programme of the UK Department for Business, Innovation and Skills; the Coordinator of LCB-HEALTHCARE.

The opportunity for innovation was presented by an eight year refurbishment programme beginning in 2010 with the vision of the CEO for a 'Hospital of the Future' a key driver. The FCP process identified an outcome-based requirement for an innovative, smart and ultra-efficient lighting solution that would deliver a step change in patient experience and in the energy efficiency of ward lighting. Market consultation helped to develop the outcome-based specification including a requirement for the solution to be 'future proofed' i.e. to have the flexibility to be superseded by new technology in the future and to be cost effective and transferable to other healthcare applications. The project, in conjunction with staff training, led to two more projects being developed at the Trust (related to zero waste and zero infection objectives). Other hospitals in England are now becoming involved through the LCB-HEALTHCARE pilot project.

### Germany

The trend towards encouraging more sustainable buildings through new approaches to design, procurement and certification is also evident in Germany. For example, the new Hochtaunus Hospital (due to open in 2013) is the first public procurement partnership hospital project in Germany. It will also be the first hospital in Germany to be certified as a 'green building' under the DGNB (German Association for Sustainable Building) scheme for new buildings.

Another good example in Germany is the BUND Label 'Energy Saving Hospital' that was introduced in 2001. Thirty (30) German hospitals have been given this Label, which is based on the rationale that up to €600 million of energy costs could be saved in the national healthcare sector, with a consequent reduction of 6 million tonnes of CO<sub>2</sub> emissions. External energy experts are used to audit the hospitals and assess them against a number of specific criteria. This includes evidence of at least a 25% reduction in CO<sub>2</sub> emissions, below average benchmark energy consumption ratios, and an energy management programme. The label is valid for five years when the hospital can apply for a follow-on certificate if it has reduced CO<sub>2</sub> emissions by at least another 5%. New hospitals have to be operating for a couple of years before they can apply for the label, which is based on actual data.

The BUND is also an advocate of energy performance contracting to overcome the capital investment barrier. One example is the Rehabilitation Centre at Bad Frankenhausen<sup>8</sup>, which has installed solar panels over its entire south-facing roof surface. The panels alone produce 40% of the clinic's hot water and 70,000kWh of electricity, equivalent to 70 tons of CO<sub>2</sub> per year.



Other examples of good practice in the German healthcare sector include the KLINERGIE 2020 project, to promote good energy efficiency practice, and the new hospital that is being built by Klinikum Frankfurt Hoechst to the passivhaus standard.

### Italy

The Italian National Government has tackled energy issues with a number of different policies and recently restated its national target of 17% energy from renewable sources by 2020. Hospitals and other healthcare facilities come under the constitutional responsibility of the Regional Governments, which have adopted different policies. In general, the Regions in the north are more advanced in their interventions than those of the centre and the south, in spite of the latter's greater natural solar and wind resources. Some hospitals have taken advantage of both National and Regional Government incentives to invest in photovoltaic systems and energy efficiency technologies, particularly in Trentino-Alto Adige, Lombardy, Veneto, Tuscany and Emilia-Romagna.

The new hospital of Venice, located in the mainland of Mestre, has been presented as an example of an innovative energy saving design. The large garden is covered by a glass diagonal 'wall' that is intended to give protection to the south side of the building and function as a temperature regulator in both summer and winter. The new hospital in Modena (commonly referred to as Baggiovara) produces much of its energy demand from a mix of geothermal, photovoltaic and biomass sources. In Tuscany, the best known example is the Meyer Children's Hospital, which won the European award in the category of 'exemplar energy conscious hospitals and health care buildings' due to its intelligent design strategy both in the rehabilitated building and the new wards. In Sicily, the Hospital of Librino near Catania is optimising solar energy and design features based on ancient Sicilian building practice to provide intelligent natural cooling for the hot summers and thermo-regulators in the mild winters

<sup>8</sup> Photograph courtesy of DRV-Bund

## Netherlands

Regulations and standards for new buildings in the Netherlands are progressively being raised in terms of environmental performance and energy efficiency. Primary legislation is derived from the Building Decree; which sets minimum standards for new buildings. The decree has in the past years become stricter in terms of energy performance; not only for buildings in general, but also specifically for buildings that are used for clinical and non-clinical functions (ie healthcare buildings). The increase in energy performance is 30% in the most recent revision. A so called 'EPC' or energy efficiency coefficient of 2.6 is now needed for clinical buildings and 1.0 for non-clinical buildings.

Another source of legislation in the Netherlands originates from the Environmental Act in which new directives have been added regarding necessary investments from large energy consumers. Almost the whole healthcare sector falls under this category. The implications of being a large energy user is that the organisation has a mandatory obligation to invest in any measures to reduce energy use that have a payback time of less than five years. The regional Environmental Agencies are responsible for controlling these actions.

Some sectors, including the public sector academic hospitals, have set themselves ambitious targets for a 30% reduction in their average energy consumption by 2015 (from a 2005 baseline). This supersedes and is more ambitious than the previous nominal targets of saving 2% energy per year. An example of this is the reconstruction of the Erasmus Medical Centre<sup>9</sup> in Rotterdam, which is the subject for the LCB-HEALTHCARE Pilot Project in the Netherlands.

However, the healthcare sector in the Netherlands is dominated by private sector providers and it is only the public providers that need to adhere to these voluntary agreements. The private sector healthcare organisations

have opted out and have no targets to meet.

In the private healthcare sector the main incentive for investing in low carbon solutions is the increased delegation of responsibility for energy costs (since 2006) and thus there is an economic incentive to reduce energy consumption.

There have been several examples in the healthcare sector where new buildings have been erected with considerably 'lower' or 'better' energy performance. The Deventer Hospital (completed in 2009) was a demonstration partner in the European project on Exemplar Energy Conscious European Hospitals and Healthcare Buildings (EU Hospitals). A trend in the Netherlands has also been to embark on more integrated contracts to design, build, operate and maintain (and finance) new hospital developments for a fixed fee. In these types of contracts the energy performance of the building is often a point of discussion as these investments have a pay-back period over the lifetime use of the building and thus the lower operational costs provides an incentive for the consortium. So far only one healthcare project is planned to follow this approach: the renewal of the Gemini Hospital in Den Helder, which has embarked on the 'Living Building Approach'. This is a public/private partnership model where total responsibility for design, build, operation and management is contracted out.



9 Photograph courtesy of Erasmus Medical Centre

## Norway

Norway launched an Action Plan for Energy Effective Buildings in August 2010, with the goal of reducing the energy consumption of buildings from the current level of 80TWh/year to 40TWh (by 2020) and 20TWh (by 2040). Important elements of the action plan include state owned buildings, which need to be 5% better than the regulated requirements. In addition, all public buyers/contractors are obliged to consider low carbon objectives when planning procurement strategies and environmental governance systems must be established by all public organisations.

In spite of Environmental Guidelines for sustainable procurement of public buildings that were published in 2004, a recent survey indicates that there are no new build hospitals that are showing outstanding performance on energy efficiency. Several Trusts are making progress partly with financial support from the energy agency ENOVA. There are also some public R&D programmes that have been launched to develop not only new technological solutions but also non-technical R&D related to new management processes for planning, design, procurement and construction. One project, launched in 2010, is exploring how to reduce energy consumption of future hospitals by 50%.

Norway has four Regional Trusts that have formed a National Environment and Energy Forum for healthcare buildings. Amongst its goals are environmental certification for hospitals and development of climate change action planning tools. So far the Forum has produced three reports; procurement, buildings & energy consumption and transportation with various recommendations to support action. For buildings, there is a focus on achieving a progressive reduction of energy efficiency standards for public buildings towards a close-to-zero-energy target of 60kWh/m<sup>2</sup>/year (the current standard is 200kWh/m<sup>2</sup>/year) and the use of energy performance contracting to address the capital

investment barriers. The LCB-HEALTHCARE pilot project in Norway is focussed on a new build acute hospital (Østfoldsykehuset)<sup>10</sup> and is following the National Guidelines for Front-end Planning of Hospitals.



An interesting example of low carbon design is the new University Hospital in Akershus, which was finished in 2008. One goal for the project was 40% energy delivered from local, renewable sources. The hospital has installed heat pumps for heating and cooling. This was a cost effective solution compared with conventional electric supplies in 2003 and is even more so today with a rise in energy prices. Another is the new Centre for Education and Research at St. Olavs Hospital in Trondheim, which will be finished in 2013. It follows passive house standards with a planned energy consumption of 127 kWh/m<sup>2</sup>/year. The project team has concluded that all technical solutions necessary are available and commercially viable to achieve the objective. The challenge is therefore about systematic implementation of the project. The contract strategy and the building process are important aspects of this.

## Poland

Poland has very rich coal deposits and for many years has been one of the world leaders in coal production and export. This meant that coal-based energy was relatively cheap but with the result that CO<sub>2</sub> emissions

<sup>10</sup> Photograph courtesy of Østfoldsykehuset HF

are relatively high. The national emissions limits under the European Union Emissions Trading Scheme (EU ETS) have therefore been set at a relatively high level so that Poland is able to sell allowances. Whilst there is no specific focus on emission reduction there are numerous cases of hospitals seeking to invest in energy saving solutions to improve their economic sustainability. This has become more important with the political trend towards privatisation of existing health care services and in the expansion of the private health care sector. Rawicz Hospital<sup>11</sup> is one example that is undergoing a phased



programme of thermal refurbishment and is participating in the LCB-HEALTHCARE project to explore how it can be more strategic, and achieve a lower carbon outcome, with the 2nd phase of its modernisation programme.

Major infrastructural projects in Poland are also being influenced by the energy efficiency and environmental standards of EU Structural Funds and related investments by EU associated countries such as Norway (Norwegian Financial Mechanism) and Switzerland (Swiss-Polish Cooperation Programme). These programmes have been important to the modernisation of hospital buildings in Poland.

### Scotland

The National Health Service in Scotland (NHS Scotland) has achieved notable reductions in energy use and CO<sub>2</sub> emissions over the years. From the original baseline in 1985/86 to 2009/10, its energy use has reduced by approximately 44%, whilst emissions over the same period have been lowered by over 41%.

The devolved Scottish Government has very ambitious targets for carbon reduction including the decarbonisation of the electricity grid by 2030. The NHS Boards are now required to report both CO<sub>2</sub> and energy statistics as part of their quarterly key performance indicators to the Scottish Government Health Directorate (SGHD) for all hospital sites. Annual improvement targets are a 3% CO<sub>2</sub> reduction from the use of fossil fuels and a 1% overall improvement in energy efficiency. Incentives for the Boards include a low interest loan scheme known as the Central Energy Efficiency Fund (CEEF) and a new non-repayable investment scheme for larger capital projects to help mitigate CO<sub>2</sub> emissions. Eight sites already have biomass boilers with capacities ranging from 100kW to 1.5MW and another 11 hospitals are planning such investments including one with a capacity of 5MW. Other initiatives include the use of Ground Source Heat Pumps (GSHP).

A good example of a new building that has been delivered is the Girvan Community Hospital in South West Scotland, which won the Building Better Healthcare Magazine's 2010 Award for Best Sustainable Design in the UK. Sustainability and lifetime cost modelling were an integral part of the design process with the aim of creating a modern building, whilst minimising its carbon footprint and ongoing operational costs. This includes a number of green technologies such as a 700kW biomass boiler, a 100kW wind turbine, together with extensive use of lighting controls as well as utilising natural light and ventilation.

<sup>11</sup> Photograph courtesy of Rawicz Hospital





At the larger end of the urban scale is the New South Glasgow Hospitals and Laboratory project<sup>13</sup>, which is one of the largest publicly funded capital projects with an estimated cost of £842m. NHS Greater Glasgow and Clyde has ensured that the overall masterplan incorporates defined energy and sustainability targets as a key deliverable for the project. The requirements for this have been developed through consultation with two government agencies; The Carbon Trust (Scotland) and the Waste Resources Action Programme (WRAP) reflecting the Board's recognition of the importance of energy conservation and sustainability. This is evidenced by their target to achieve a BREEAM excellent rating for all new projects on campus.

### Sweden

Sweden has ambitious 2020 climate and energy policy goals including 50% of energy from renewable sources, 40% reduction in greenhouse gas emissions compared to 1990 and energy efficiency increased by 20%.

In Stockholm, the County Council (SSL) has a long tradition of environmental programmes, currently in its fifth phase, which cover energy, transport, pharmaceuticals, chemicals and chemical-based products. Some of the goals by the end of 2011 include: at least half of the County Council's passenger and goods transport operating on renewable fuel; all

electricity and cooling should come from green energy sources and at least 75% of heating to come from renewable sources.

Further south, the Sustainable Healthcare (SHC) project is a joint venture between the healthcare sector and leading Swedish companies that offer sustainable solutions related to waste management, energy efficiency, heating and cooling, chemicals, IT, transport, architecture, etc. It is financed by a consortium including the Swedish Agency for Economic and Regional Growth, Region Skåne, Sustainable Business Hub, Business Region Gothenburg, Region Västra Götaland, the Healthcare Technology Alliance and participating companies. The aims of the project are to promote economically affordable solutions that contribute to the health and well-being of the patients and staff while decreasing the environmental load from hospital operations, increase the export of sustainable solutions in order to generate larger profits for participating companies and initiate pilot projects that contribute to more sustainable hospitals.

Region Skåne has the ambition to become CO<sub>2</sub> neutral and is active in a number of health sector projects. For example, it is running an EU LIFE+ project on climate friendly health and care (CLIRE). One of the sub-projects is concerned with saving energy in a large building at Malmö University Hospital and includes a 'green roof' with moss and sedum. Another is the heating and cooling plant at Kristianstad Central Hospital that is based on 100m deep ground wells. It has a heat output capacity of 3MW and a cooling capacity of 4MW, which has reduced the hospital's purchased energy by nearly 80%.

**The LCB-HEALTHCARE website [www.lowcarbonhealthcare.eu](http://www.lowcarbonhealthcare.eu) provides links to further information on the above examples and we welcome others that offer lessons on how the healthcare community in Europe to minimise its carbon footprint.**

<sup>12</sup> Photograph courtesy of Health Facilities Scotland

## 2.2 European initiatives

### European Networks

Health Care Without Harm (HCWH) Europe is part of an international coalition of 484 organisations in 53 countries working to transform the healthcare sector so it is no longer a source of harm to people and the environment. In Europe, HCWH has a network of nearly 70 members in different countries. HCWH is working with the World Health Organization (WHO) on a number of initiatives and collaborates with many other organisations worldwide to create a global network for climate friendly healthcare.

The European Hospital and Healthcare Federation is an international non-profit organisation that represents national public and private hospital associations and hospital owners, either federations of local and regional authorities or national health services. It is made up of 32 organisations coming from 26 Member States of the European Union, plus Switzerland. The mission of HOPE is to promote improvements in the health of citizens throughout Europe, high standards of hospital care and to foster efficiency with humanity in the organization and operation of hospital and healthcare services. It published a report in 2009 entitled "Does EU environment policy influence hospitals and public health? Good practices of hospitals with improved energy performance". The report includes 25 examples of hospitals in Europe that have improved their energy performance either by increasing energy efficiency or by investing in renewable energy systems.

### Intelligent Energy Europe (IEE) Projects<sup>13</sup>

**COGEN CHALLENGE** - European campaign for the development and documentation of 1000 small-scale cogeneration projects in European Cities and Towns.

**EINSTEIN II** – Expert system for an intelligent supply of thermal energy in industry and other large scale applications like hospitals.

**EPLABEL** – A programme to deliver energy certificates for display in public buildings across Europe within a harmonising framework.

**ManagEnergy** - a technical support initiative that aims to assist actors from the public sector and their advisers working on energy efficiency and renewable energy at the local and regional level. The website includes a variety of good practice case studies including some in the healthcare sector.

### Other EU Projects

**EU Hospitals** – a project on Exemplar Energy Conscious European Hospitals and Healthcare Buildings was funded by the 5th EU Framework Programme for RTD and involved five demonstration hospitals in Denmark, Germany, Italy, Netherlands and Poland.

**BuildHealth** – a project on holistic energy conscious and sustainable strategies in the health care sector was funded by the 6th EU Framework Programme for RTD. It involved three demonstration hospitals in Italy, Moldova and the UK.

**HOSPILOT** – a project on intelligent energy efficiency controls in hospitals that was funded by the CIP/ICT programme.

**HealthClusterNET** - EUREGIO III project, which is concerned with using Structural Funds for healthcare infrastructure projects. It involves a network of regional health authorities in Europe.

**PreCo** - a project funded by the EU FP7 programme with the aim of enhancing the use of pre-commercial public procurement (PCP) in the EU. There are two specific thematic fields in PreCo: eHealth and eEnergy.

**SCI-Network** - another Public Procurement Network funded (like LCB-HEALTHCARE) under the Lead Market Initiative. It is looking at sustainable construction & innovation through procurement, particularly in European cities.

<sup>13</sup> Two new projects that are relevant to the healthcare sector have been recommended for funding under the 2010 Call for IEE Proposals. These are known as RES-HOSPITALS (exploitation of renewable energy systems in hospitals) and ReCo (raising energy performance in existing non-residential buildings)

### 3. Barriers to Low Carbon Innovation

Stakeholders were invited to participate in an online survey of good practice and barriers to investment in low carbon healthcare facilities. The detailed feedback is included in the Appendix and based on almost 100 completed questionnaires from a cross-section of stakeholders in nine countries. Half of the responses were from healthcare ministries, agencies, local funding bodies and management. The remainder were operational facility managers, architects, engineers or

the construction supply chain and the building services industry.

Of course, this cannot be regarded as a comprehensive or fully representative survey of the overall situation in Europe but it does highlight some interesting messages, which are discussed below, and we hope will lead to a wider debate on the implications for stakeholders.

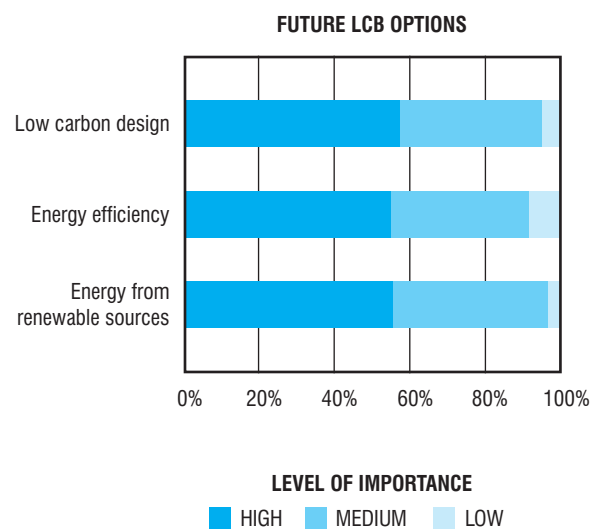
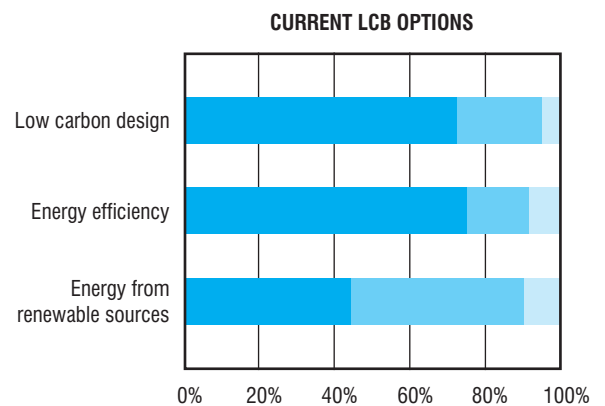
#### 3.1 Key messages

##### Investment in energy efficiency is the priority at present

Whilst low carbon design is considered to be the answer for new buildings, the priority for low carbon investment in the huge existing stock of healthcare buildings in Europe is energy efficiency. This includes insulation, energy management and combined heat & power (CHP) systems. Nearly 80% of the sample considered these to be of high importance. The majority feel that renewable energy is of medium or low importance at present.

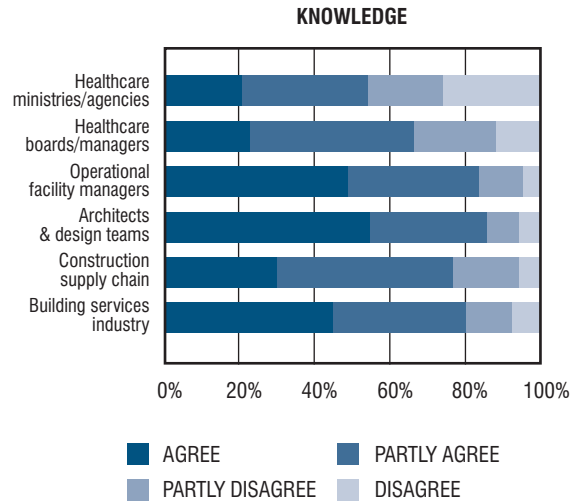
##### Energy from renewable sources will become more important in the future

Virtually all respondents indicated that they think energy from renewable sources will be much more important in the future. Only two respondents (both from Norway, which is moving towards a zero carbon electricity network) regarded this option as being of lower importance for the future.



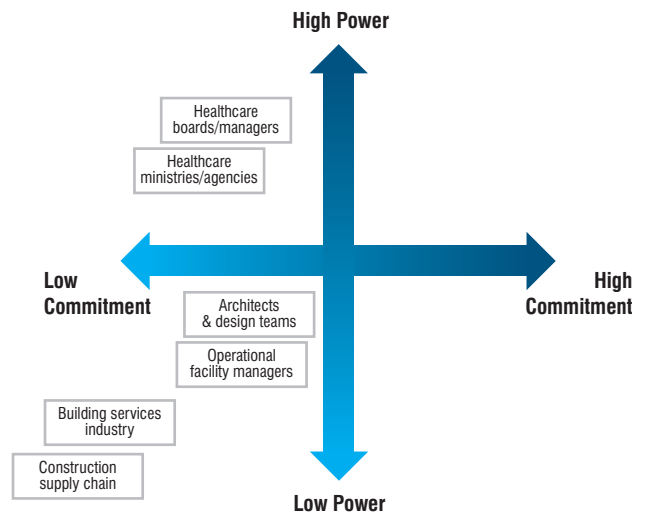
**The technical KNOWLEDGE to design and build lower carbon facilities appears to exist (or is emerging) at the operational level**

In general, it appears that architects & design teams and operational facility managers have the most KNOWLEDGE to influence the planning and procurement of low carbon buildings. In contrast, the policy decision makers in healthcare ministries, agencies and management boards appear to have the least knowledge.



**None of the stakeholder groups are considered to be the 'champions' of low carbon buildings**

Less than 50% of the sample 'AGREED' that any of the six main stakeholder groups have the commitment to influence the planning and procurement of low carbon buildings. Architects, design teams and operational facility managers are regarded as having the highest commitment. Healthcare ministries, agencies, boards and managers clearly have the highest power. The construction supply chain and the building services industry appear to have the least power and commitment.



This suggests that there is both a lack of demand at present for low carbon innovation and a lack of initiative from the supply chain to promote low carbon solutions. The lack of commitment from any of the main stakeholders is quite an unusual finding in this type of survey. There is plenty of anecdotal evidence that this is the general situation and that there is still a high degree of inertia to change traditional practice in both construction and renovation. This vicious circle is one of

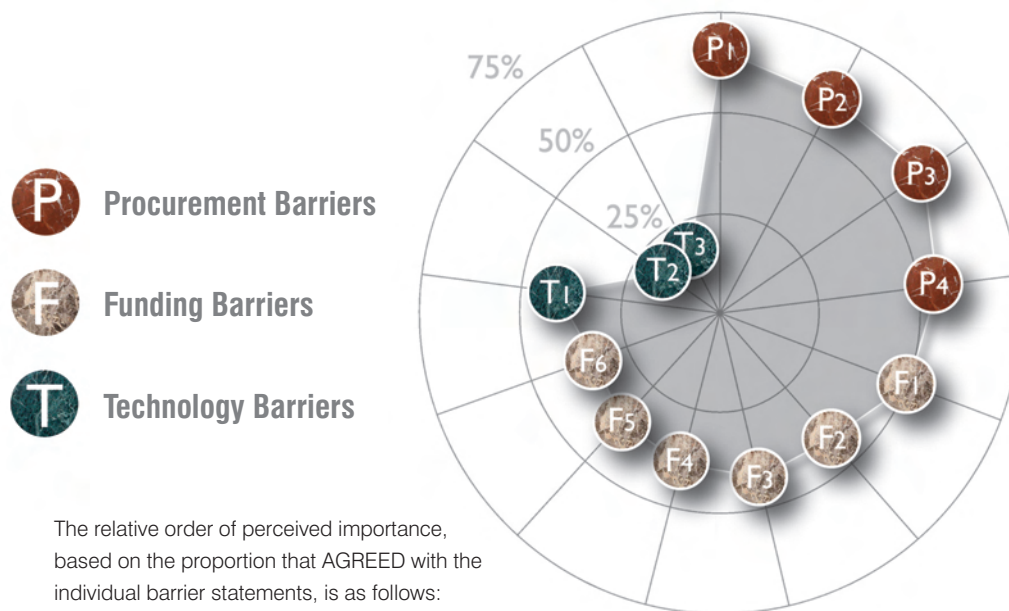
the reasons for the LCB-HEALTHCARE project and the inclusion of sustainable construction and renewable energy as two of the five priorities for the European Lead Market Initiative. Clearly, increasing the commitment of the most powerful stakeholders (ie healthcare boards/managers and healthcare ministries/agencies) should be a priority. The survey indicates that the supply side has the knowledge but appears to be inhibited by a lack of demand for innovative, low carbon solutions.

**Procurement practice appears to be the most important barrier**

The survey invited participants to agree or disagree with a number of possible barriers that were segmented under three categories; funding, procurement practice and immaturity of solutions. The analysis for each category is included in the Appendix and indicates that the majority either agree, or at least partly agree, with

most of the procurement and funding barriers. The technology barriers appear less important.

The relative importance of the procurement barriers is most obvious when considering the proportion of those who expressed full agreement for each of the 13 specific barriers. This is shown below (% of the sample that AGREED with the barrier statement).



- P1 Procurement practice for healthcare facilities is still biased towards initial capital investment cost rather than whole life costing
- P2 Political targets to reduce CO<sub>2</sub> emissions from buildings are not yet translated into mandatory procurement criteria
- P3 There is a lack of pre-procurement dialogue on low carbon options between buyers and the supply chain
- P4 Procurement specifications do not explicitly encourage low carbon outcomes
- F1 Low carbon investment is not yet a high priority for healthcare facility owners
- F2 There is a lack of financial incentives for facility owners/managers to procure low carbon solutions
- F3 There is a lack of financial incentives for suppliers to develop and demonstrate low carbon solutions
- T1 There is a lack of building owners/developers/managers that are willingness to work with suppliers to help develop and demonstrate new low carbon solutions
- F4 The financial services sector is not willing to take the risk in providing money for low carbon technologies and solutions
- F5 Low carbon solution providers cannot provide attractive financial offers (eg lease finance, performance-based charging)
- F6 Facility managers cannot make the business case for investment
- T2 Existing low carbon solutions are not economically viable
- T3 Existing low carbon solutions are too high risk

Clearly, the relative importance of the barriers may vary from country to country and even by region. This appears particularly the case for the financial barriers and it is interesting to note that technical risk is not considered to be one of the main barriers. The four procurement barriers clearly dominate, which suggests that they are common issue in most if not all countries.

## 3.2 Implications for stakeholders

The most interesting conclusions from the analysis for the LCB-HEALTHCARE project are the dominance of the procurement-related barriers and the apparent lack of market demand for low carbon innovation. This appears to have two main dimensions.

Firstly, it appears that many stakeholders in healthcare ministries, agencies, managing authorities and hospitals do not have sufficient knowledge or commitment to create the demand for low carbon solutions - including those that are both technically and commercially feasible. This report has highlighted a variety of good examples in different countries of what is possible both at policy and operational level. The remainder of the LCB-HEALTHCARE project will therefore focus on both producing and signposting guidance and learning materials related to the procurement of innovative solutions. This will be based on the experience of the national pilot projects and analysis of good practice case studies.

Secondly, it is clear that low carbon policies have not yet influenced wholesale changes in procurement culture. To make matters worse, the European debt crisis appears to be further inhibiting the policy and fiscal interventions that will be needed to overcome the procurement barriers. This is an important policy issue for all European stakeholders (not just in the healthcare sector) that are concerned with sustainable construction, reducing the significant carbon footprint of all types of buildings and achieving the EU Energy 2020 Targets.

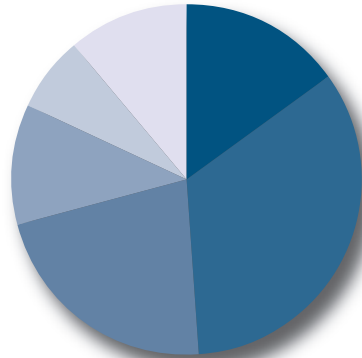


The LCB-HEALTHCARE consortium is committed to share experience and information on best practice procurement, lead market methodologies and case studies related to the design, construction and refurbishment of low carbon buildings in the healthcare sector. Future publications will focus on good practice guidance and learning materials.

## APPENDIX: Survey Results

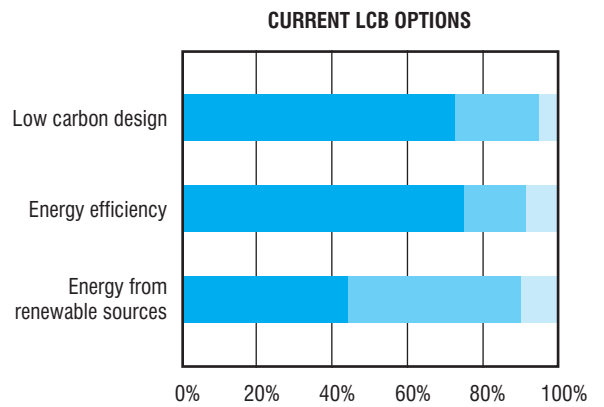
Which of the following stakeholder categories best describes your organisation's role in healthcare buildings and facilities?

- Healthcare boards / managers
- Healthcare ministries / agencies
- Operational facility managers
- Architects & design teams
- Construction supply chain
- Building services industry



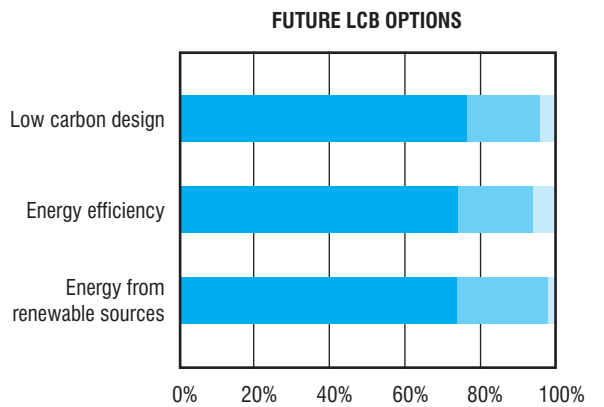
What do you think are the most important CURRENT options to achieve low carbon healthcare facilities?

- Low carbon design of new or refurbished buildings
- Energy efficiency (including options like Combined Heat and Power)
- Energy from renewable sources



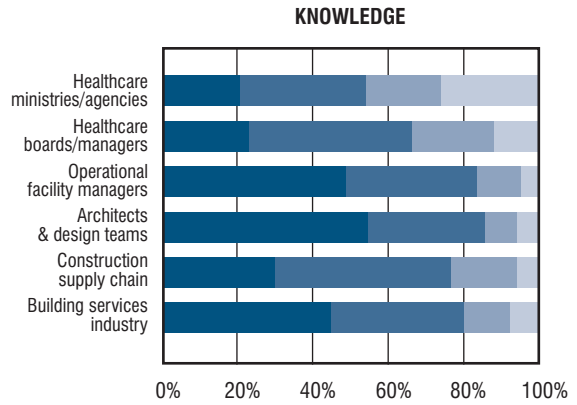
**LEVEL OF IMPORTANCE**  
 ■ HIGH ■ MEDIUM ■ LOW

What do you think are the most important FUTURE options to achieve low carbon healthcare facilities?

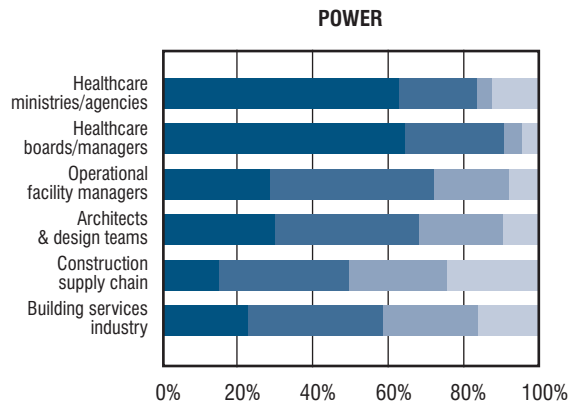


■ AGREE      ■ PARTLY AGREE  
■ PARTLY DISAGREE    ■ DISAGREE

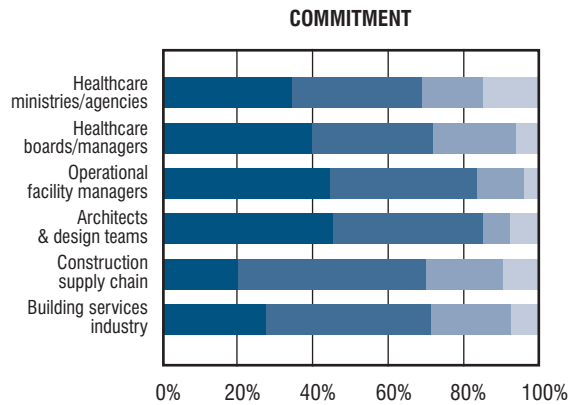
To what extent do you agree that the following stakeholders have the **KNOWLEDGE** to influence the planning and procurement of low carbon building solutions?



To what extent do you agree that the following stakeholders have the **POWER** to influence the planning and procurement of low carbon building solutions?



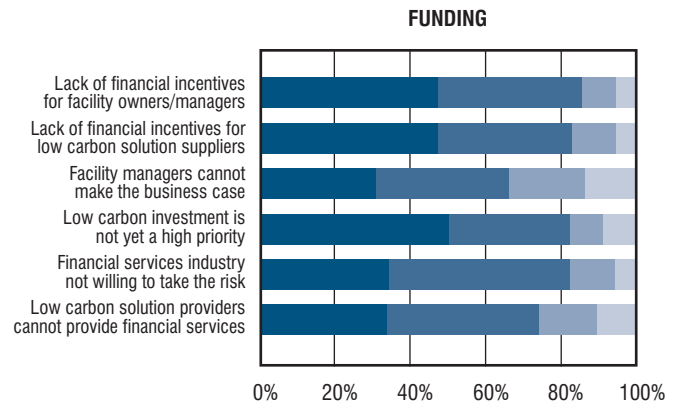
To what extent do you agree that the following stakeholders have the **COMMITMENT** to influence the planning and procurement of low carbon building solutions?



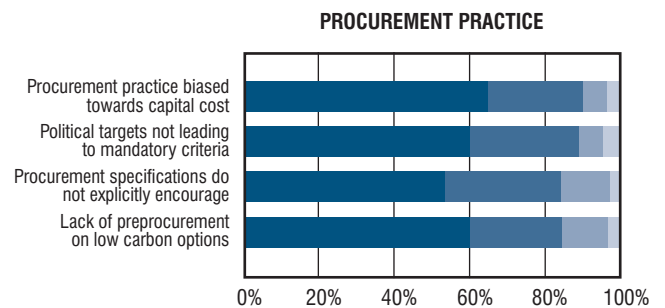




FUNDING is clearly one of the barriers to the exploitation of low carbon technologies and solutions. To what extent do you agree with the following?



PROCUREMENT PRACTICE is often mentioned as a barrier to the exploitation of low carbon technologies and solutions. To what extent do you agree with the following?



It may be that IMMATURITY of low carbon building technologies and/or new design & construction methods is a significant barrier. To what extent do you agree with the following?

