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► **To cite this version:**

Gilles Debizet, Martin Symes. Expertise and Methodology in Building Design for Sustainable Development: A Franco-British Comparison. Ian Cooper & Martin Symes. Sustainable Urban Development Volume 4 Changing Professional Practice, Routledge, pp.197-228, 2008. halshs-00920510

**HAL Id: halshs-00920510**

**<https://shs.hal.science/halshs-00920510>**

Submitted on 18 Dec 2013

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*Pour citer cet article :*

*Expertise and Methodology in Building Design for Sustainable Development. Debizet G., Symes M., Dans Sustainable Urban Development Volume 4 Changing Professional Practice, Ian Cooper & Martin Symes, Routledge 2009, pp 197-228*

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## Chapter 9

# Expertise and Methodology in Building Design for Sustainable Development : A Franco-British Comparison

Gilles Debizet<sup>1</sup> and Martin Symes<sup>2</sup>

Sustainability introduces new goals in building design and requires new skills and project management methods. These include environmental assessment methods, the choice and use of which often has a marked impact on the outcome. Comparing the use in practice of the French evaluation system HQE and that most often used in Britain, BREEAM, permits the identification of shared trends in these two countries but also suggests that one of the reasons for a variety of outcomes lies in the structure of these assessment methods. To some extent, these depend, too, on national traditions of development, and of governance.

After a description of the differences in context, the chapter reports case studies of a number of construction projects in France and in the Southwest of Great Britain. The cases illustrate the impact of introducing Environmental Evaluation methods while taking account of the fact that bringing Sustainable Development into play differs between the two countries. The two groups of cases, taken together, suggest that the initial goals of a development team cannot be maintained throughout a project without compromises to meet the needs of local communities and politicians. In addition, they suggest that the new roles to be played by the various professions are especially problematic for architects and engineers. To some extent the outcomes differ from country to country because of the different frameworks of professional responsibility.

## USUAL STRUCTURE OF BUILDING DESIGN SERVICES

Building design requires attention to qualities of use and the ability to maintain them against foreseen and unforeseen turns of events. Design takes also into account the financial limit and the balance between investment and working costs. Design mobilizes many types of knowledge (Architecture, Mechanical, Energy, Chemistry, Hydraulics, Economy, Law, Project Management etc ...); it mostly organizes professions of building design in each country. Of course, relationships between the professionals vary according to the project. But design activities<sup>3</sup> and specific professionals contributions seem to be also circumscribed by usual national arrangements. We will first focus on differences according to the country.

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<sup>3</sup> E.g. estimation of needs during briefing, imagining form and building structure, choosing between technical systems and materials, checking the building performance, drawing prescriptions for builders, overseeing the building site etc...

## **A simple arrangement in France with a sequential process**

French history has left its mark on the building sector. Political centralisation created both a powerful group of state engineers and a prominence of creativity and art in architect education. Some laws precisely define the roles between developers and designers, and between architects and engineers.

According to laws, developers are presumed “non sachant” (unknowing), which means that they are supposed to ignore technical rules and the art of building. However, in the case of state or community paid buildings, developers (public authority or agency) must define their needs in a briefing session before choosing the design teams in competition. For example, the type of heating system is defined by the briefing. The briefing stage should be very scrupulous because a change of requirements by the developer during the design phase could cause contract annulment. The contracts between private developers and design teams are more flexible; the partner can negotiate most of the items. However, both practice and jurisprudence distinguish the responsibility for definition of needs (briefing to be done by the client) from that for design.

Apart from small buildings like a house, design teams contain at least an architect, a structural engineer and often a thermal and electrical engineer. These professionals working on the same project usually belong to different companies. According to the building size, developers have to introduce other kinds of professionals: structural and fire controllers, a quantity surveyors and later, a working site planner and a working site safety controller. Office and large commercial buildings usually require other specialists: a computer system network engineer, a lighting engineer, an aerialist engineer, a fire system designer etc..

Regulated by rules, these professions are structured in small and specialised firms. Architects actually first create the form and the structure building on their own. After developer confirmation, the structural engineer checks the forecast structure and eventually modifies the size of wall, beam or floor. After approval of the detailed plan by the developer, the thermal engineer assesses heating and air conditioning load and defines most of the elements of the system. Then, the design team members cast the writing and the drawing of the technical prescriptions for builders; so they also cast the responsibility of the future building performances according the specifications writing. Technical specifications casting is inspired by public standards that in fact organize the division of work between many building trades: bricklayers, carpenters, joiners, plumbers etc...

Regulations and jurisprudence are based on (and also organise) a traditional division of activities between the client and the design team members. Even for private projects, contracts and jurisprudence are largely inspired by public project regulations. So briefing and design respect usually the same sequential process for long years ago. The profitability of design firms, converges with this routine process. Architects invest much effort in the outline form and the façade and less into framework (or thermal behaviour).. Then, engineers precisely design framework (or thermal system) and guarantee performances. However, building design is regularly confronted with new aims, which require more cooperation between architect and engineer. Environmental quality and thermal performances requirements could dominate the building design process in the coming years.

## **A variety of arrangements in the UK**

History has also left its mark on the British building industry, but so has the legal system which is not based on Roman Law but on Cases (precedents determining the likely outcome of any dispute) and provides for considerable flexibility in practice. Some would say this allows rapid response to changes in the market for construction services.

UK architects train by taking the examinations of the RIBA (granted a Royal charter in 1837), or by obtaining exemption at a recognised School of Architecture, and are then qualified under the Architects Directive of the EU. This permits them to use the title architect, and requires them to conduct themselves in a professional manner and to carry insurance against professional liabilities. However the function of architectural design is not protected by law (as it is in France) and it is not uncommon for engineers (such as Arup) to lead a design team. The argument that architects' standing should depend on their creativity, and that professionals should have the freedom to practice however they think best is still taken seriously.

During the 1980s, the period of "Thatcherism", government initiated a reappraisal of the privileges accorded to many of the established professions. Architects lost the ability to prescribe their fees, and official studies of procurement methods in construction (see chapter in this book by Henry and Paris) recommended the use of various new types of contract, partly in the hope of reducing the uncertainty which was associated with innovation in architectural design. These are often administered by specialist project managers (usually surveyors). So architects now see themselves as generalists and leaders in building design, but often are treated as if they were only specialists contributing to the definition of construction projects. Whether design for sustainable development is a general requirement of architects or the preserve of specialists, is thus an issue of major interest for the professions and the UK cases in this chapter will throw some light on current practice.

The Standard form of Contract for Construction projects (JCT) treats the architect as being appointed by the developer (building owner) and acting on his behalf during the design phases, up to and including the specification of details and the obtaining of tenders (costs), this last activity normally being competitive [Willis, 1981]. During this period, the architect will recommend the developer appoint consultant engineers and surveyors to work with the architect (if the architect's firm does not already employ its own in a multidisciplinary team) under the architect's instructions, so an integrated design can be proposed at all stages. After tenders have been received, the developer appoints a construction firm and the architect's team changes role. At this point they become administrators of the contract and should deal fairly with complaints (for example about lateness of information) whether received from the builder or the developer. This system is thought to work well for medium sized projects, but to be unsuitable for very small buildings (where it is better for the developer to act as his own builder, employing tradesmen as direct subcontractors). On very large construction contracts, use of the traditional system has been thought to lead to the contract administrator receiving enormous numbers of complaints (requests for variations) and then to immensely long legal procedures, after construction has been completed, being needed to resolve the final account (the total cost). This situation led both to client dissatisfaction with the process and to "offers" by other professions to take over the architects' role (they may have little skill in this area and have to pay high fees for insurance cover). Hence the growth of management contracts mentioned above.

Management contracts come in two broad types : in the first, a construction firm takes on the project management role after a preferred tender has been accepted, and thus cuts the architect out of his contract administration role during the construction period, and in the assessment of final cost. In the second type, the construction firm is appointed (competitively if thought appropriate) at the same time as the design team and works alongside it from the beginning, being therefore implicated in all decisions made at this time. A variation on this method is known as Design Build, in which the construction firm employs the architects and other design team members, offering a « one-stop service » to the developer. Sometimes the latter will also employ a surveyor to monitor cost implications of decisions as they are made, thus overseeing both contractor and by implication, architects in their employ. A further innovation has been the development of “partnering” in which all members of the design team share some of the financial risk.

The most recent innovation in construction procurement in the UK is the Private Finance Initiative (MIQCP 2006) a new methodology for designing, building and operating buildings in the public sector. In these contracts, the builder (not the developer) raises the finance required and then owns the building for an initial period of its operation, leasing it to the user organisation until the time comes for ownership to be transferred back to the developer (in fact a government department set up specially to act as its property arm). In principle, PFI and associated types of contract should make the achievement of sustainable development easier, as all relevant factors can be taken into account, and the long term time scale is explicitly included. However PFI has been criticised for giving too much weight to purely financial constraints. One of the UK case studies in this chapter is based on a PFI project.

## **NEW ENVIRONMENTAL ASSESSMENT METHODS IN FRANCE AND THE UK**

Since the 90's, some environmental assessment methods have been developed in France and the UK. In each country, one “movement” has given rise to new frames of reference [see chapter 7 by Henry and Paris]. In France, the “Haute Qualité Environnementale” Association put forward a single new approach to building briefing and design (see chapter Paris and Henry). In Great Britain, the Building Research Establishment<sup>4</sup> developed an approach to environmental assessment methods, various versions had been created for use in different circumstances.

### **France : HQE®**

HQE® is a registered trademark that can be used by developer to qualify a building, particularly the approach of briefing, designing and working. Currently, two types of building can be certified as an HQE® project: offices-schools and single houses. Since 2004, another certification (“Habitat et Environnement”), that was also inspired by the HQE approach, applies to housing buildings, but it do not allowed HQE trademark use and not respect the following paragraphs.

*An approach defined originally by environmental requirements and a managementsystem*

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<sup>4</sup> Development of BREEAM pre-dates the privatisation of BRE and hence the establishment of the Trust.

The HQE approach had been originally defined by two guidelines in 2001. The DEQE<sup>5</sup> (Définition Explicite de la Qualité Environnementale) proposed roughly 150 architectural and technical prescriptions or requirements, which could be assessed. These requirements were grouped into 14 targets:

- relationship between building and immediate environment, choices of construction process and materials, low nuisance construction site,
- energy management, water management, waste management, repair and maintenance management,
- hydrothermal comfort, acoustic comfort, visual comfort, olfactory comfort,
- sanitary conditions of indoor spaces, air sanitary quality, water sanitary quality.

The SME<sup>6</sup> (Système de Management Environnemental) was based on ISO 9000 standard. It described when, how and what kind of performances should be checked at the different stages of the construction process.

### *Current certifications*

Based on these two texts, HQE Association and Centre Scientifique et Technique du Bâtiment<sup>7</sup> worked with AFNOR<sup>8</sup> to built up certifications. Two are currently used in France.

“NF bâtiments tertiaires –démarche HQE” certificates offices and schools. This certification has been tested in 2004. The protocol settles on many requirements grouped into 14 targets. Requirements concern mostly performances rather than technical solutions. Evaluation defines a level of satisfaction by target. At least 3 targets should be assessed very efficient, 4 should be efficient and the seven other could be standard. First the developer chooses the satisfaction level of targets. The building project is assessed at three moments: end of briefing (briefing), just before building work contracting (design) and delivery. Usually the assessor (licenced by the certification organisation [see chapter Paris and Henry]) converses with the developer and design team during the project process. In may 2007, 7 buildings were definitely certified, 31 succeeded the design stage and 33 the briefing stage<sup>9</sup>; most of them are situated in greater Paris area and started by private real estate companies. Certification including assessment costs 12,000 € (lower than 1,500 square meters) to 40000 € (upper than 45,000 square meters). Because its high cost, this certification cannot actually interest small office buildings. Anyway, the penetration of certification is low, even if we consider only large office building projects in France.

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<sup>5</sup> Association HQE, Définition explicite de la qualité environnementale Référentiels des caractéristiques HQE, , Document 5-15 novembre 2001, 26 p.

<sup>6</sup> Association HQE® - Référentiel du système de management environnemental pour le maître d'ouvrage concernant des opérations de construction, adaptation ou gestion des bâtiments, 23 Novembre 2001.

<sup>7</sup> CSTB is a French public establishment similar to BRE in UK.

<sup>8</sup> Association Française de Normalisation is the French correspondent of International Standard Organisation.

<sup>9</sup> Certificats NF Bâtiments Tertiaires - Démarche HQE® - Mise à jour du 16/05/2007, Certivea, 5 pages.

Certivea is a certification company depending on the state agency CSTB (Centre Scientifique et Technique du Bâtiment).

“NF maison individuelle –démarche HQE” certifies a contractor and then the houses, which satisfy the protocol. Contractor agreement is inspired by ISO9001 standard. After agreement, the contractor is allowed to use the brand and offer his clients a HQE house. A part of 175 requirements deals with the means to brief eg. site investigation, design eg. checking methods and delivery eg. instructions for use. Most of the other requirements are performances or technical prescriptions and gain credits. Hundreds of credits could actually be allocated but thirty suffice to satisfy certification. Roughly one hundred contractors are allowed to offer HQE® houses in France. They register an HQE® house project to a certification organisation and send some information during the construction process, one house in five is actually assessed on the spot. This certificate is not very particular about environmental quality, but it is about quality management. It is useful to improve the transparency in the relationship between client and contractor: national regulations satisfaction of new individual homes should be at least an important progress especially about energy efficiency and environmental quality.

HQE approach has an important influence over local authorities and consequently real estates companies and developers. The keen interest by local authorities and housing companies is not reflected by the low number of certificated buildings. In February 2005, the HQE association listed six hundred projects announced by their developers [Association HQE, 2005]. However, a large majority of them did not enter in a certification process.

CERQUAL, a building quality certification organisation, offer a new label. “Habitat et Environnement” is inspired by the DEQE documents (cf. above), it describes checking and calculation methods but the requirements are less numerous and not grouped into 14 targets, energy management takes over from other HQE items. The protocol does not combine an environmental management system. The certification process is greatly easier. This certificate is well received by housing trusts and home real estate especially in the west part of France and Paris area<sup>10</sup>. Even if it is minority among new housings, it could be considered as a main development for this traditional activity. Note that CSTB and HQE Association prepare a new certification (“NF bâtiment d’habitation–démarche HQE”), other certification organisations could be in competition with CERQUAL for licensing housings: this type of building is the main building construction sector.

#### *Development of the methodology.*

We identify two new protocols which could be very influential in the coming years. HQE Association prepares a protocol for developments: it answers a HQE controversy about the difficulty to improve environmental quality if the project is limited to the building. Conversely, a new label will be soon created by the main building economic stakeholders to promote only energy efficiency. “Effinergie” will look like Minergie<sup>11</sup> and Passivhaus. Straightforwardness and low cost of certification will be its strong points compared to the HQE approach.

#### **The UK: BREEAM**

Sunnika (2001) summarises the UK approach to managing sustainable construction as follows:

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<sup>10</sup> 148 buildings were certified and 300 in progress according CERQUAL web site ([http://www.cerqual.fr/pro/habitat\\_environnement/programmes.php](http://www.cerqual.fr/pro/habitat_environnement/programmes.php) consulted the 2nd of June 2007)

<sup>11</sup> Minergie and Passivhaus were originally developed respectively in Switzerland and Germany. They care only about energy saving and renewable energies.

The government has invested considerable effort in promoting sustainable building measures, but the level of ambition is not very high and implementation is mainly voluntary.

She concludes that there are no economic measures and no relationship with social aspects, although our analysis suggests that there are few such characteristics rather than none at all. As reported by Henry and Paris in Chapter 7, the British National Strategy for Sustainable Construction has two main components : regulatory (modification of the Building Regulations and other laws) and advisory (the issuing of a variety of Guidelines, including BREEAM). A Land Fill Tax was introduced in 1996 but fiscal approaches are not generally favoured, except in respect of social housing. In addition mandatory codes are in the process of introduction for rating the performance of all new housing .

#### *Topics, links with design process, certification*

Sunnika's review of the controls aimed at sustainable construction summarises the regulatory component as having four main branches : measures for the control of pollution (Environmental Protection Act 1990), for water conservation (although the Water Resource Law 1991 deals only with ground water protection, not the use of water), for the use of materials and the management of waste (this being a voluntary standard : BS 7543) and for energy saving. The Environment Act 1995 established an Environment Agency and a Sustainable Environment Protection Agency and was accompanied by a Home Energy Conservation Act requiring local authorities to plan for an improvement in the levels of CO<sub>2</sub> and other emissions.

The structure of the main Building Regulations (Act of 1984) illustrates the flexibility of the British approach to legislation. They are divided into a number of parts, of which Part L, dealing with the conservation of fuel and power concentrating on methods of saving energy and providing a number of methods for calculating these savings, has been updated a number of times. The most recent addition is the Energy Performance of Buildings Regulation of 2007.

It is noticeable that the guidelines for housing have been introduced separately from those for other building types. This is partly because the housing construction industry operates as a separate sub-industry from that concerned with the majority of commercial and public buildings, and partly because the housing industry has a diversity of other control systems in place. Public (or social) housing is financed by the Housing Corporation, which uses its own Housing Quality Indicators and has implemented ISO 14001, but until recently has considered sustainability to be a community issue, not a technical one, and relied on bringing its influence to bear on Local Agenda 21 processes. Private housing is by and large left to « the market » which varies considerably from one part of the country to another. The Building Research Establishment (BRE) produced a voluntary guide to Ecohomes (its use being a main topic of one of our case studies) and has encouraged the use of the Green Guide Specification for Homes.



At the time of writing, this situation has changed (see RIBA 2006). The present government seems to be moving towards a policy of regulating performance. Ecohomes has been replaced by a Code for Sustainable Homes from April 2007. This will be voluntary for twelve months, then becoming mandatory for new homes from April 2008. However a distinction is drawn between the different housing sectors. Private developments will have mandatory assessment only to begin with, but social housing will have to meet a certain standard (known as level 3) for water consumption and carbon emissions immediately, the Housing Corporation applying this to the next public funding round. Other aspects of the code (building materials, surface water run-off, pollution, health, ecology and management) are to be rated but specific performances not required. The energy component of the new standard will become the level for revised Building Regulations two years later, applicable to all new housing but the government maintains that for private sector sales or leasing there will be no new financial implications, an Energy Performance Certification system, with similar standards, having already been announced for June 2008. The plan is for energy standards to be gradually raised over the next few years, reaching zero carbon-emissions for new housing by 2016. A consultation document on the introduction of water efficiency in new homes as well as in commercial buildings) has also been released. Interestingly for the theme of this book, for the housing sector improvements, a network of licensed assessors will need to be established to provide Code certification.

The principal Guideline considered in the remainder of the UK case studies is that introduced by the BRE in 1990 : BREEAM (BRE Assessment Method). At the time the BRE was a government agency but it has since been privatised and users of BREEAM must be prepared to obtain a licence or pay a fee. It proposes various simple measures, each of which is evaluated using a system of « points », with a minimum level of achievement on each but no summary scale. Overall judgements are provided using the terminology « very good », « good », « fair ». BREEAM is not officially certified in way that HQE is in France, but there are firms who act assessors, under licence from BRE. Some of these are architects seeking a new line of business. The case studies in this chapter show how flexible the application of BREEAM has become.

#### *Development of the methodology.*

Versions are updated regularly (they are intended to have a ratchet relationship with increasingly demanding Building Regulations) and different versions have been created since its launch to assess various building types.

These versions essentially look at the same broad range of environmental impacts:

- management: overall management policy, commissioning site management and procedural issues
- energy use: operational energy and carbon dioxide (CO<sub>2</sub>) issues
- health and well-being: indoor and external issues affecting health and well-being
- pollution: air and water pollution issues
- transport: transport-related CO<sub>2</sub> and location-related factors
- land use: greenfield and brownfield sites
- ecology: ecological value conservation and enhancement of the site
- materials: environmental implication of building materials, including life-cycle impacts
- water: consumption and water efficiency

Credits are awarded in each area according to performance. A set of environmental weightings then enables the credits to be added together to produce a single overall score. The building is then rated on a scale of Pass, Good, Very good or Excellent.

BREEAM exists currently<sup>12</sup> for nine building categories: Schools, Retail, Offices, Prisons, Multi-residential<sup>13</sup>, Industrial Units, New homes, Existing homes and Courts. Requirements depend on category. As shown below the numbers of assessments made varies from fifty to many hundreds. No doubt, this is partly a result of different volumes of building in each sector.

Different assessments can be carried out according to building categories. The main types are:

- Design and procurement: at the design stage for new build or refurbishment projects,
- Post construction: first assessment or second one to ensure that BREEAM issues specified are implemented according design and procurement assessment,
- Management and operation: whilst building is operational assessment considers policies and procedures in addition to existing building and fabric layout.

In the case of new buildings, the developer pre-assesses credits score and requests usually a licensed BREEAM assessor during the design stage. BREEAM Office checks assessor assessment before delivering building certification to the developer and adds details of developments to the BREEAM Database (unfortunately not available for public inspection).

Outside standard BREEAM categories the developer requests an assessor first to develop a bespoke method in accordance with a BREEAM consultant and secondly to assess the design or the construction. Bespoke BREEAM experiences help to develop new standards<sup>14</sup>.

Many Government offices, Local Authorities and Housing Corporations request very good or excellent rating for their own development or on the land they have sold. So a wide majority of offices or industrial unit assessments satisfy these ratings. BREEAM has spread widely in the United Kingdom since 2000 as the following statistics show.

Insert About Here

Table 9.1

UK / No. of Assessments	Offices	Industrial Units	Ecohomes
2000	50	11	1
2001	66	2	9
2002	97	26	32
2003	84	20	94
2004	94	29	549
2005	100	50	1152
2006	132	55	1224
Very good or Excellent	83%	74%	23%

Source: Stats for BREEAM Buildings March 07, BREEAM Office

<sup>12</sup> May 2007

<sup>13</sup> eg. student residence, elderly housing or hostel.

<sup>14</sup> School BREEAM started 2004: 11 buildings have been assessed on the 16<sup>th</sup> of March 2007. Retail BREEAM started 2003: 4 buildings assessed.

A recent thesis (Bartlett, 2005) argues that “for sustainability to be successfully taken into account...there must be a client-driven agenda....a means of measurement and the use of tools”. An illustration of the significance of this proposition (and the difficulty of achieving it) is given by government procurement experience. In 2002, the government body concerned introduced a requirement for the achievement of an Excellent rating by all newly procured buildings in the government estate. However a recent report by the National Audit Office has shown that only a minority have been offered for assessment and few have achieved the rating specified. Some of our UK case studies discussed below show factors leading to success and failure in this respect.

To support the use of BREEAM, the BRE has developed : BRE Environmental Profiles (based on information regarding Life Cycle Analysis(LCA) and with Ecopoints giving a reference on materials and components which may be used), ENVEST (a design tool, also using LCA), and a set of BRE Environmental Management Toolkits for Offices, for Schools and for Local Authority buildings. These combine guidelines and checklists. The case studies below will show that BRE has been flexible (and opportunistic?) in collaborating with the major public agencies responsible for building procurement to develop versions of their guidelines to suit the needs of these agencies.

### **HQE and BREEAM: main summary of the comparison**

When designers, developers and their clients (if they are represented) discuss environmental performance, the environmental assessment methods are, in both countries, often considered to be a new standard language. According to their instigators [Birtles 2004, AHQE 200?] this is an important reason for judging these two methods to have been successful.

BREEAM is currently more wide spread than HQE. It started earlier. It gives a score while HQE gives yes-or-no. Requirements are usually less numerous. It assesses the result of design and construction and not the process as does the HQE approach. Both have been applied to different building categories. Both BREEAM and HQE consider the main environmental items impacted by building. They both care about global, local and indoor quality.

### **TEN CASE STUDIES OF THE IMPACT ON THE DESIGN PROFESSIONS**

To understand how the needs for considering sustainability and for the use of environmental assessment methods modify the roles of developers and design team members, we have observed the course of a number of building projects. Studies were made of the promotional and institutional documents defining each project or its developer, together with a selection of working documents produced and used by the project team members. Main project team members, including those directly concerned with the environmental aspects, were interviewed.

We singled out projects with respect to these criteria:

- a size sufficient to justify the resort to a specialist in environmental management
- a project in which the environmental ambitions were reasonable from an economic point of view and so repeatable in other projects,
- a project progress sufficient to be sure that building design would be definitive.

## Insert About Here

Table 9.2 Case Studies In France and Great Britain

Building project	Locality	Type of Contract	Cost M€	Purpose	Dates (Design to Delivery)
Eco Homes	Langport	Traditional	3,8	Housing	2003-2005
NHS Trust	Swindon	Private Finance Initiative	200	Hospital	1999-2003
Whitehall	London	PFI/JCT	43,7	Office	2001-2005
Architecture Studios	Bristol	Design & Build	4,3	Higher Education	2000-2002
Hotel de Ville (City Hall)	Les Mureaux Ile de France	Marché de définition	7,5	Public office	2002-2005
Hotel de Ville	Echirolles Rhône-Alpes	Architectural outline competition	15	Public office	2002-2006
Halle des sports	Voiron Rhône-Alpes	Architectural outline competition	5,3	Sport hall	2003-2006
Building 270 EMGP	Aubervilliers Ile de France	Design private contract (negotiated)	14	Office	2003-2005
INEED	Chatuzange Rhône-Alpes	Architectural outline competition	6,3	Office	2003-2006
Résidence OPAC38	Bourgoin-Jallieu Rhône-Alpes	Architectural outline competition	5	Housing	2002-2003

For each operation, we intended to interview at least four professionals: developers or project manager, architect, thermal engineer and where applicable, environmental manager. Research resources allocated by the “sleeping partner” (PUCA) allowed us roughly fifty interviews. Finally, we chose ten projects: four in Great Britain and six in France. In each country, we avoided projects where phase of design had not ended. During the investigation period, some buildings were finished while others were under construction. We tried to select both public and private projects in spite of a relatively small number of private ones.

### **Six Case Studies in France**

All French studied cases involved HQE approach however these projects began before the certification existed. Three had been assessed by HQE certified assessors (actually during design stage). Two of them were finally certified (Les Mureaux City Hall and “Building 270” EMGP Company), they were the first five “NF bâtiments tertiaires –démarche HQE” certified buildings. So, these cases could be considered as experimental process.

### *Description of the cases*

Located in Bourgoin-Jallieu (24.000 inhabitants, 40 km from Lyon), this five floor Residence OPAC 38 contains sixty flats. L'OPAC38 is a Housing company depending on the Isère District<sup>15</sup>; this public company was several times distinguished for innovation in renewable energy use. The client, chose ADRET Consultancy as AMO-HQE from the beginning, they adopt the HQE-approach<sup>16</sup>. They focused attention on:

- Materials (e.g. brique monomur, doors and windows in wood ),
- Energy management (solar sanitary water, PV, reinforced insulation etc...),
- Water management, thermal comfort (wide wall inertia),
- Low nuisance construction (noise, waste management).

This project began before certification appeared. Brickwall was the main difficulty during design and, above all, during construction; the masonry contractor spent much more time than forecasted. Neither architect, nor contractor had an experience with this material.

Located in Grenoble suburb, the Hotel de Ville in the new center of Echirolles city (35.000 inhabitants) was created around new the tramway line (since 1987). The new City Hall groups the municipality council and the headquarter (200 persons, 6.000 square meter). Two three-floors office buildings are linked by an atrium. Deputy major in charge of Environment persuaded the city council to adopt an HQE Approach. The programmist<sup>17</sup> and AMO-HQE had been chose together. Architectural outline competition was based on both a functional and environmental briefs that defined environmental priorities. Highly performing targets were:

- Relationship between building and immediate environment,
- Low nuisance construction site (site waste management mainly),
- Energy management (new air cooling/preheating by underground, cooling by groundwater, heating by city rubbish incineration etc...),
- Repair and maintenance management (footbridges in front of the façades, easy access to piping and wiring, easy remove partition, revetment resistancy etc...),
- Hydrothermal and visual comfort (fast no windows on west and east faces, mobile and semi-automatic sunshade on south face and over the atrium, individual modulation of temperature, thermal inerty by concrete floor etc ...).

The main controversy inside the project team (client representatives and designers) concerned the air conditioning. During the competition, designers announced a heat pump. However whilst design stage, the client refused an “electrical solution” and preferred use the city heating network (issued from rubbish incineration) in winter and a direct cooling by groundwater in summer. Designers considered that groundwater cooling could not satisfied required internal summer temperature: the thermal engineer strongly opposed this nature dependant<sup>18</sup> system and the conseiller environnement studied carefully thermodynamically building behaviour. Finally, the client accepted to lighten temperature requirement: ten days by year internal temperature could be over 28°C.

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<sup>15</sup> Conseil Général de l'Isère, France

<sup>16</sup> SME and DEQE written by HQE Association in 2001.

<sup>17</sup> A programmist writes the briefing with and for the client.

<sup>18</sup> The cooling powerful depends on the groundwater flow and temperature.

Briefing and design stages were successfully assessed by HQE assessors; however the city of Echirolles refused to pay certificate, so the third stage (delivery) was not assessed and the building is not HQE-certified.

The Région Rhône-Alpes has included a Sports Hall when restoring the Lycée Ferdinand Buisson during the period 2003-2011 after long discussions and studies that began in 1996 [Pinel 2005]. Located inside the nineteenth century school park, the Hall was destroyed and rebuilt by the Communauté d'Agglomération du Pays Voironnais (CAPV)<sup>19</sup>. One large exhibition hall, three training rooms and some technical and office rooms have to be used by pupils and many sport clubs of Voiron. The programmer, who had already worked for CAPV in 1996, proposed a HQE approach for this project in 2002, so he was too the AMO-HQE of this project. According the brief, the highly performing targets were:

- Relationship between building and immediate environment (to balance parcel narrowness and other buildings proximity)
- Energy management (energy saving)
- Acoustic comfort (internal adsorption and external insulation especially during public competition).

During competition, designers announced solar PV, vegetative roof, heating floor and new air preheating by underground. However, designers (and then client) have underestimated architectural outline and energy saving solutions, despite AMO-HQE notifications. During design stage, architects did not agree to move architectural outline and the client refused to overspend, so he finally gave up solar PV and underground preheating. He did not commit HQE certification.

A new Town Hall is located in the center of Les Mureaux City (a suburb new town that was built around an old village during the 60'), the old city hall was too small and the central square inappropriate for a 32.000 inhabitants city. Urban regeneration project is decided in 2001. City administration wrote a pre-brief and the council invited to tender for a briefing and design contract<sup>20</sup>. After selection of the three teams, the client chose to apply the HQE approach as the environment responsible deputy-major put forward. Each team drew a specific architectural outline in relationship with client representatives (energy manager, maintenance manager and general manager); they developed the brief in the same time. A young architect, engineers, project planner and a programmer, which was already HQE experimented, formed the winner team. The building was already basically designed when the client decided to certify<sup>21</sup> the project and recruited an AMO-HQE. According project progress, five highly performing targets had been chosen:

- Low nuisance construction site (because location in city centre)
- Energy management (saving, water/water heat pump, solar water sanitary)
- Water management (rain water use for garden and toilet, saving water taps)
- Waste management
- Repair and maintenance management.

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<sup>19</sup> CAPV is a local federation of 50 municipalities around Voiron City (80.000 inhabitants together).

<sup>20</sup> The 'Marché de Définition' is an exception to the sequential process described above (imperative distinction between briefing and design stages). If a local authority identifies a need but is not able to define precisely the nature and the scope of the project, the law allows it to invite a tender for both briefing and design (according a very imprecise pre-brief). Two teams at least should be selected to design urban and architectural outline, then the winner team continues the next design stages alone.

<sup>21</sup> In 2003, HQE Association invited developers to experiment with the new "Bâtiment tertiaire – démarche HQE" certification.

The Chambre de Commerce et d'Industrie de la Drôme developed the INEED office building in Chatuzange to welcome innovative companies, some regional foundations in relation to biology, wood and sustainable building and a training centre. The project (3600 square meter, three floors) is located close to the TGV railway station of Rovaltain (80 km south of Lyon). Developer and AMO-HQE (he is also the programmer), focused on:

- Choices of construction process and materials: wide wall brick (combined with concrete porticos), mixed floors (concrete and wood), natural earth coating
- Energy management: insulation and thermal inertia with wide brick, variable double flow ventilation, underground air pre-heating/cooling, solar PV, heating regulation.
- Water management: vegetative roof, rain water use for toilet,
- Hydrothermal comfort especially in summer: sunshade, climbing vegetation, desktop computer banning, nocturnal over ventilation.

Actually, a concrete structure was already summary designed when developer required using wood for structure. Many studies and an extension of time were necessary to introduce wood floor. Discussions opposed developer (especially AMO-HQE) with design team (especially structural engineer and architect). Developer did not start a HQE certification process.

EMGP Company is a private developer of Building 270 EMGP. The company specialises in office and commercial building. It owns many parcels inside an old industrial area very close to Paris city (Aubervilliers). Building “270” consists of seven storeys welcome offices (8.400 square meters), a ground floor (1.000 square meters) and 128 parking spaces on two basement levels. A first building licence was obtained in 2001; it concerns an usual concrete structure with glass façade. In 2002, this company decided that “building 270” will experiment HQE approach especially to reduce the use costs and for marketing reasons. The project manager (developer representative) turned to an AMO-HQE to modify the initial project: with the architect and the engineers (structural and thermal), they formed a real project team. Architectural form was preserved but walls and coating finally moved. This building was one of the first five HQE certified projects. Six targets were assessed as highly performing:

- Relationship between building and immediate environment because the proximity of Paris peripheral highways.
- Energy management: variable double flow ventilation, variable lighting controller, highly thermal insulation,
- Water management:
- Waste management: rain water use for garden and toilet<sup>22</sup>,
- Repair and maintenance management: ability to access and repair wiring and piping,
- Hydrothermal comfort: air conditioning.

### *Environmental topics and performance requirements*

As written above, a developer can choose his priorities among topics related by the assessment method. He has to answer two questions that are somewhat related. Which topics should have priority over the others? What level of performance should be defined?

A developer is cautious about these choices. First, some of the environmental topics are actually opposed: they cannot be completely satisfied together<sup>23</sup>, a developer has to find the

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<sup>22</sup> Governmental sanitary administration did not actually allowed using rainwater in toilet inside building 270 ... unlike Les Mureaux City Hall.

<sup>23</sup> Thermal comfort could be easily expected with high energy consumption that produces CO<sub>2</sub>. Luminosity in deeper rooms requires high windows that could cause overheating.

balance between two or more topics. Secondly, topic requirements usually have repercussions on building costs: most of the topic combinations can either be achieved with just monetary sacrifices or by restraining architectural freedom. Therefore topics choice and performance requirements could be considered as part of the building design process, even if resorting to designer's team happens after them.

We will discuss later the conjunction between topics choice and requirements, budget for project and professionals casting. First, we shall explain the main factors of topics choice and then we will describe the topics that have been deeply studied and disputed between designers and developers.

### *Factors influencing the choice of environmental topics*

In France, the HQE target choice is determined by the thematic priority of the developer. The most usual aims concern internal comfort and energy conservation. These aims could be considered antagonists but they are often explained together. Then, maintenance facility, surrounding relationships and weak nuisance worksite worry secondly developers. The other aims, still important but not so usual, concern the resources and construction materials: the use of local ones seems to be an unofficial priority.

These choices are conditioned by developer organisation. Pre-existing internal skills prompt developers to focus on some topics. Inability to be understood by decision-makers (the client) or high construction cost prompt developer to remove topics.

Then, the facility to respect some HQE requirements (vice versa difficulties to reach other requirements materially) encourages the developer to balance between his own needs and the luck to get HQE certificate in economic conditions.

### *Particularly disputed or deeply studied topics*

During design, any requirements that prove too costly or too difficult are combined. That could cause tension within a design team. The official design team leader (usually the architect) normally decides to respect the initial requirements and proposes costly solutions. Therefore, the final decision belongs to the developer. He balances between lower performances and higher investment or higher functioning cost.

At this stage, the environmental assessment method plays an important role in project process.

In France, the HQE method makes explicit requirements before the design team begins to work. Design teams have to assess the environmental performances of their own design; developers ask them if they do not. Only few topics have truly been deeply studied and discussed among designers or between them and the developer:

- Heating production means are often compared and optimised: global cost during the life period of the heating system is the first criteria, CO<sup>2</sup> emission is also an important criteria.
- Use of natural heating resources is also discussed: it concerns solar for domestic hot water and heating, preheating of external air by underground circulation and, of course, bioclimatic design. A thermodynamic computer simulation of future building is often made to verify and optimise reliability and profitability.
- Equilibrium between luminosity and summer overheating requires factor calculation as well as thermodynamic computer simulation, especially in the case of wide building with central atrium or an east/west oriented building.



- An innovative system with interference in both frontages, structural and/or thermal compartments pulls designers to long discussions about calculation hypothesis, reliability and economic effects.

Two other important topics that do not involve designer much: size of the car parking is discussed for a long time inside the developer company; waste management needs fine and detailed definition with contractors.

### *Roles in building design team*

Environmental assessment method introduces new topics and new methods in the construction process. It modifies both the decision-making inside the developer company and the design process. However, situations and developments seem different according to the country.

In France, new professionals appear among the project team. One helps the developer to choose priorities and to look after environmental performances during design and construction stages. He has been named AMO HQE (Assistant Maître d’Ouvrage Haute Qualité Environnementale). Another professional works inside the design team, we name him « conseiller environnement »<sup>24</sup>.

### *Roles of AMO HQE and conseiller environnement in France*

AMO HQE is recruited by the client from the briefing till the end of construction; sometimes he has to assess two years after the building comes into service. He helps directly the developer; he does not have any official or contractual relation with design team. During the design stage, he prepares and takes part in regular meetings between developer and designers. We identify five roles:

- a passer : he brings knowledge and methods, first to developer and then, to design team.. He may give any document end references to design team.
- a mediator: in case of divergence between departments of developer company or authority, he reaches a compromise and finally acts as a catalyst for environmental performance requirements. Sometimes, he proposes methods to go to a compromise between developer and design team.
- an expert: his skills enable him to guarantee some performances or, vice versa, to call an announced performance into question. Considering the diversity of environmental topics, the AMO-HQE refrains pronouncing every topic.
- a monitor: he looks after the respect of environmental performances expected by the developer all over the building process. He notifies the developer of any risk of failure.
- an embellisher: he makes building project seem environmental friendly, sometimes more than it really is. He advises developers to present the best environmental aspects of the project.

These roles are mentioned in chronologic order of apparition; however they exist often simultaneously especially during the design process. According to context, developer organisation and also, skills and willingness of designers, the AMO-HQE plays more or less the different parts. The AMO-HQE should not be only an expert of environmental impacts but also a thematic consultant including strategy and pedagogy facets. If they do not, he prompts the designers (especially architects and engineers) to work more together. That is also the job of the ‘conseiller environnement’.

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<sup>24</sup> In fact, the same environmental (or sustainable building) specialist works either as AMO HQE or as conseiller environnement, but never both in the same project.

The 'conseiller environnement' is recruited by the design team to complete the team skills. His experience in sustainable building or environmental oriented design is useful to win the race<sup>25</sup>. Like thermal engineers and structural engineers, he deals his income with the design team leader (architect usually). His contribution is limited to design stage. We identify four roles:

- a passer: he brings physical or chemical knowledge and technical solutions to the design team. If thermodynamic computer simulation is required by the developer or necessary to guarantee any performances, he makes or subcontracts it. He suggests the calculation hypothesis to structural or thermal engineer.
- an expert: he guarantees some environmental performances or at least the methods to assess them. Because of the high diversity of HQE requirements, he is used to resort specialists of other environmental topics.
- an embellisher: in case of architectural outline race, he makes building outlines seem environmental friendly, then he advises the designers to explain the environmental advantages.
- a designer: he contributes to design but he usually does not draw or write specifications for contractors unlike architects, thermal engineers or structural engineers.

Most HQE-competent among design team, he naturally becomes a direct speaker of the AMO-HQE with whom the relationship is usually antagonistic. He interferes in the traditional relationship between architects and engineers.

#### *Transformation of role of the architect and engineers*

Relationships inside design teams were more numerous and more fertile than they are for usual projects. During design, the prospect of assessment forces team members to exchange data and to question usual technical and architectural solutions. When he is monitoring environmental requirements, the AMO-HQE contributes to broad cooperation inside design team. His contribution is relatively delimited by the HQE® approach even if his skills and his relationship have an impact on the cooperation scope.

HQE approach requests design team members to deliver hypothesis data and layout sheets whilst design (and not only after design in comparison to BREEAM). Relationship between architect and engineers could be both controversial and cooperative. We identify four main factors:

- Income. Designers originally forecast a number of working days for the project. During design stage, they spend time over to improve the project if they expect a long-term benefit (e.g. emblematic building, learning by cooperation, satisfaction of a powerful client, etc ...). Otherwise, designers avoid changing of methods and technical solutions because that spends time.
- Legal responsibilities. Usual design team members carry on the responsibility of a type of requirements according regulations, jurisprudence and, sometime, contract in case of private development<sup>26</sup>. An innovative solution increases usually the risks of unsatisfactory; designer is careful especially when he has to write the technical specifications.

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<sup>25</sup> In every studied case, the *client* required HQE skills.

<sup>26</sup> Individual design team member responsibility is linked to the writing of the building work technical specifications. For exemple thermal engineer becomes responsible of the comfort temperature achievement in winter because he designs the heating system.

- Skills in relation to environmental requirements. Some environmental preoccupations like carbon emission or indoor-air quality are relatively new. Knowledge and experiences are currently very heterogenic among architects and among engineers. Knowledge and individual experiences help to assess the risk of unsatisfactory requirements and contribute to clarify responsibilities and cooperation.
- Conseiller environnement roles. Conseiller environnement seems to be very early involved in architectural design. However neither regulation nor jurisprudence delimits precisely his individual responsibility, he is officially an adviser. So, according his relationship (that depends on his incomes, his reputation making expectation, his skills and his nature), he contributes to collaborative or controversial working ways.

### *Conclusions of the French Cases*

The six French cases show a transformation of project process in comparison to usual sequential process. Innovative solutions were introduced, new professionals appeared (AMO-HQE and Conseiller Environnement), cooperation increased inside the design team, developer requirements and design choices were explained. We observed this transformation varies according the cases; client representatives and design team cooperate highly in case of private contract or “brief and design contract”. Solutions were more innovative in case of public development. If we consider the satisfaction of enquired professionals, a successful HQE building project depends on:

- initial and constant willpower from the developer,
- AMO-HQE competence, rigour and tact,
- knowledge and skills inside the design team (usually brought by Conseiller Environnement but sometime by another team member),
- desire to learn and progress of all the team members.

Perenniality of this transformation is still a question. Is necessary cooperation generated by environmental assessment or by introduction of unusual aims? Would AMO-HQE and Conseiller Environnement be still useful if environmental friendly knowledge would be spread through building professionals?

- Conseiller Environnement utility depends on his ahead in comparison to other team members. As they progress, he will likely specialize: e.g. thermodynamically behaviour simulation, life cycle materials analysis etc... His contribution could become occasional during the design process. An eventual Conseiller-Environnement profession could be permanent only if national regulation and jurisprudence give him any responsibility inside the design team, that is most unlike.
- AMO-HQE knowledge could trivialize. However, his contribution as mediator and monitor would be indispensable to developer especially for non-recurring project. Actually outsourcing trend favours this “new profession”. It do not need any regulation because an AMO assists the developer: their relationship are only contractual. Moreover, the AMO-HQE could advise sometime a design team (and so become a Conseiller Environnement of some projects in which he is not involved as AMOHQE).

## Four Case Studies in the UK

To understand the rather different context of British practice in sustainable development in more detail, four detailed case studies were carried out. These were broader based studies than those undertaken in France, not focussing only on the use of the BREEAM assessment methods, which in a number of the cases had not been introduced when the projects were initiated but only introduced at a later stage in the process.

The following questions were considered:

1. How does the organisation of the work on a project respond to sustainability objectives and how is their achievement evaluated ?
2. To what extent does the political context, including economic constraints and legal structures, lead to a better understanding of how to improve outcomes ?
3. How do the professions have to adapt and what differences are developing in the roles of client and design team leader?

The following sections also emphasise cross-cutting issues. The first section introduces the scale and complexity of the projects and reports on the environmental evaluations to which they were subjected. The second explores the effects of developments in policy, especially those connected with new contracts and associated new methods of financing investment in the public sector. The third can then go into further detail of the commissioning, design and construction processes, and emphasise the reorganisation of professional roles.

### *Description of the Projects*

These projects were all located in areas of Great Britain which favour growth, investment and innovation. They are drawn from both public and private sectors. It was not possible to include social housing, nor to deal with the problems of the former industrial zones of Northern cities.

The first project is an example of private housing development (Ecohomes), the second and third are major investments in public services (Architecture and Planning Studio is in Education: NHS Trust Swindon in Health. The fourth project (Whitehall Place) is the refurbishment of a building of historic interest.

Ecohomes cost 2.6 million pounds. It consists of 8 houses, 4 flats and a number of common facilities. The site is in the SouthWest of England, a highly desirable area. Design work started in 2003 and construction lasted from 2004 to 2006. Architecture and Planning Studio had a total cost of 2.9 millions pounds, and contains 9 studios, a workshop, a laboratory, seminar spaces and offices. It is on the main campus of a “New Universty” in the West of England. A feasibility study was undertaken in 1998 and construction was completed in 2002. NHS Swindon is much larger: a 550 bed hospital with parking for 1100 vehicles, and the construction cost was 135 million pounds. It is on the edge of an Expanded Town which has had a high level of growth in jobs and homes, beginning in the 1960s. Discussion of this project started in 1993 but the new building was not opened until 2003. Whitehall Place is between the two scales: requiring the demolition of most of an out-of-date office block, of which the main façade was listed and had to remain unaltered. The interior was rebuilt and the construction cost came to 29.5 million pounds. Whitehall Place is in the centre of London. This project also took ten years to complete, with a feasibility study in 1995 and occupation of the new offices in 2005.

### *Evaluating Sustainability*

All four projects were evaluated in accordance with BRE norms, these norms having sufficient flexibility to be applied to many building types. These valuation processes were linked to design objectives and had an influence on the running of each project.

In the case of Ecohomes, the client's project manager was a certified auditor of the BRE Ecohome evaluation kit. So he acted as an adviser to the architect on construction techniques, the choice of materials and selection of sub-contractors. The main client for the Architecture and Planning Building was unwilling to pay for a formal evaluation to be undertaken, but the user group made an informal evaluation themselves. This showed the building to be "Very Good" on the BREEAM scale for office buildings. In developing the Swindon hospital, the NHS Trust's design team developed its own evaluation tool, NEAT (Environmental Assessment Tool) in cooperation with the BRE. Whitehall Place was graded "Excellent" against the BREEAM criteria.

### *Finance and Contracts*

Policy influenced the financing of Ecohomes but not its contract. The Regional Development Agency, a government body, had as a goal "to promote the three pillars of ecological development...an ecological approach, consultation with the local population and a contribution to the local economy". The Agency had a particular interest in one of the common spaces of the project, a refurbished warehouse, and that new jobs be created there. A part of the finance was therefore guaranteed, as was another part by the County Council, who pursued the same aims.

For the construction phase, a conventional JCT contract was used. In the interviews, it was reported that "despite this choice, the budget was only exceeded by 10% and the contract period only had to be extended by three months". It was also said that one of the lessons of the project was "not to use this form of contract: the risk is too great.. it does not encourage the partnership approach which is needed".

The Architecture and Planning Building demonstrated modest innovations, in finance and in the contract. The source of part of the construction cost was another government body (Higher Education Funding Council), as they wished to support "research projects which included the use of information technology and led to practical training outcomes". As for the contract, the University used a special form of JCT Contract (Design and Build). This transfers responsibility for the final cost to the contractor (allowing for agreed variations only) and allows "much better financial control".

It is therefore of particular interest to consider the other two case studies, as in both used innovative Public Finance Initiative contracts. This approach, dear to the New Labour governments, requires there to be a partnership between public and private organisations for the delivery of new public services. The private organisation is expected to shoulder the risk in return for favourable financial terms.

Thus with the NHS project, the Trust retained ownership of the land, but a Hospital Company (of which the contractor was a major shareholder) financed the construction over three years, and has taken responsibility for maintenance over the next 27 years. The Trust pays a monthly rent to the Company and settles the accounts for services used (electricity, water etc). Those involved said the construction went well being completed on time and to budget. In addition the contractor was able to show that the cost was not much above that for similar projects. The main problem arose later when it emerged that energy consumption was 30% higher than might have been anticipated. And it appears that the contract did not give priority to meeting the goals of sustainable development. There was no objective figure included for energy consumption, and no method laid down by which energy use would be managed. A Trust representative maintained that “the responsibility is shared” but it is the Trust which bears the unexpected expense: there is no penalty for the contractor (Carillon).

Even at Whitehall Place, these innovations were not completely adopted for the contract was only partial PFI (JCT type). It covered finance, the design, construction and renovation of the building, but not the facilities management required when it was brought into use. One of the consultants involved also said “it would have been preferable to define the environmental specification clearly and precisely at the beginning of the project”. In the event, the owner client did not hesitate to give appropriate financial support on occasions when the specification was altered during the running of the contract to meet client needs. And since they have completed their work on this project, the architects involved have been unable to persuade more conventional clients to make ecologically sound design choices when adverse cost implications would have followed.

The adoption of new partnership-type contracts clearly does not guarantee avoidance of the conflicts of financial interest which can arise in design for sustainability.

#### *Adaptation by Professionals*

The goals of sustainable development and the new expertise required was partly introduced by the client for Ecohomes as the project was initiated by the Somerset Trust for Sustainable Development, the main developer. Their mission statement is “to make sustainable construction the norm by 2010”. The project manager had undertaken a number of training courses which led in this direction, including one on Building Conservation. The consulting engineers had previous experience of sustainable construction, as did the “quantity surveyor”, and the construction company had already worked on a “dynamic house project” which included active insulation. However, the architect had no prior knowledge of design for sustainability. Some of the gaps in knowledge were supplied by the Trust, who had a library of technical specifications which focus on ecological construction.

However in the case of the Architecture and Planning Building it was the representative of the future users (Professor Colin Fudge) who first thought of it as having to respond to the needs of the environment. He had acquired a strong interest in environmentally conscious design while working in Australia in the 1980s then deepened his knowledge by carrying out various studies for the European Commission in the 90s. The client who would own the building ( the University's Estates Department) only became involved with sustainability issues at the end of the briefing phase. The choice of the main contractor (Willmot Dixon, who was also responsible for design under the Design and Build Contract) was also unconventional, as some of the other tenderers were persuaded to withdraw when it became clear that they were unhappy with the ecological design approaches required. Then a further member of the future users' group (Lecturer Craig White) monitored the detailed design, working with a firm of engineers (Buro Happold) who had acquired considerable skill in this area, especially in design for energy conservation. Other measures considered included the reuse of rainwater, the choice and treatment of timber, the use of solar panels, and the calculation of air movements (so that natural ventilation became possible). There were some conflicts between the users (teachers) and owners (University authorities), but most decisions were resolved with reference to a "value engineering" approach, which took long term costs into account.

At Swindon the NHS Trust did not specify a sustainable development in the early stages, but their interest grew when it became clear that this was a national concern. Neither did the contractor selected (Carillon, also designer under the PFI system) use sustainable design as a selling point. Nonetheless this firm took advice from a specialised consultancy (Natural Step) who convinced them that a sustainable approach could limit their financial risks, especially at the margin. In order to obtain the contract, Carillon had had to develop a "business case" and a "public sector comparison" for the final cost of their propositions. They included: control of water use, recycling waste, choice of materials and relationships with suppliers. The building economist undertook research, established a database of good practice and a record of lessons learned from experience.

Whitehall Place was also a special case, as priority was given to retaining the principal façade. It also appeared impossible to introduce natural lighting or to use solar panels, both architectural strategies which would have made a substantial contribution to energy conservation and hence sustainability. The owner client was the Crown Estate, but the users were to be the Department for Environment, Food and Rural Affairs (DEFRA) who established the detailed brief and clearly had a strong interest in sponsoring a building with minimum environmental impact. They set out a "sustainability Charter" which was accepted by the contractor (who had design responsibility), their architects and their engineers. At the end of the day the building was classed "Excellent" on BREEAM, account being taken of such factors as the use of materials, insulation, waste treatment, lighting controls. One of the most important decisions taken was to install an ammonium-based cooling system, as this does not destroy ozone. For one of the architects involved "ecological design is an apprenticeship".

### *Conclusions of the UK Cases*

The conclusion of the British cases was that a new structure of professionalism is in the process of being defined and that this has consequences for architects working in the UK construction industry. Innovations in the technical performance of buildings are clearly at the heart of design for sustainable development. Our case studies suggest that in practice aimed at achieving this, British architects have to adapt to:

1. Finding a context for construction where long term investment is encouraged.

2. Introducing design evaluation systems suitable for the building type
3. Understanding that new objectives may be introduced by any of the actors
4. Learn from experience throughout the project
5. Seeking financial support from all branches of government
6. Responding to requirements for new contractual arrangements
7. Solving conflicts of interest at the earliest possible moment

## **THE FUTURE OF THE PROFESSIONS AND OF ASSESSMENT METHODS**

The following comments are drawn from the information gained in undertaking the case studies, as well as on the reviews of institutional arrangements which precede them.

### **The professions**

In Britain and in France, those involved in the promotion and design of environmental assessed developments to have a ~~much~~ better understanding of the context in which construction will occur, in order to identify and solve conflicts of interest at the earliest possible stage. This is surely could be an adaptation which is long overdue. Sustainable development is a goal which should lead ~~clearly~~ in this direction. Thinking about environmental impact, about future patterns of use and about the financial provision to be made for external costs, is fundamental to this approach but has rarely been correctly implemented in the past, as construction is an activity in which short term thinking has tended to prevail. The new professional skills demanded by the call for clear assessments of sustainability will make this more likely to happen. So there is recent bound to be pressure on planners, architects, engineers and, in Britain, surveyors, to obtain, and offer to the market, the knowledge which is required. In France it seems that a new professional activity (oriented towards the client body and sometime towards the design team) is emerging. In Britain, the more probable scenario is that certain members of the existing professions will compete to claim "ownership" of this knowledge. As a consequence, some architects and engineers may become highly skilled in this area, but others will find the investment required is not viable.

The existence of assessment methods, in both countries, makes the latter problems less likely to arise. In France it is well established that are new technical requirements which must be addressed, and for some professionals (those accustomed to objectifying their design choices), this may not necessarily call for a change in behaviour. But the locus of responsibility is changing in design, with architects taking a smaller share of design decision-making and some technical support teams (thermal and environmental BET) having stronger roles. In Britain the much more widespread arrangement of design firms as multi-disciplinary companies, in which architects and engineers (some very specialised) become accustomed to working together, may facilitate the use of evaluation tools and speed up their introduction to normal "everyday" practice.



In the view of the authors of this chapter, the probability that new objectives may be introduced to a project by the client and other actors in (or around) the development team (users, neighbours, AMO-HQE ...) is highly significant. The British cases make this abundantly clear: there is often no fixed brief or immutable set of requirements to be met. In the instances where the client is not naïve (as in France he officially has to seem!), and when the knowledge-base is developing rapidly, such flexibility can have very positive effects. The importance of taking true account of environmental impacts was shown to be stressed by a number of different actors and at different stages in the development process. The general public (users in the long term) also has role to play in promoting better accountability. Voluntary bodies, the well educated pressure group members, those taking up legal or political positions, can all take over what up till now has always seemed the prerogative of the professional. How far this kind of action will spread to France in the coming years, remains to be seen. In Britain, the focus of professional legitimacy appears to be changing, in France it may have to as well.

A process of professionalisation involves the development of innovative technologies (including low-tech and social innovation), the search for a market to which this new knowledge can be offered, and the influence of government in promoting and supporting an emergent and specialised approach. These conditions are arising in practice from the diffusion of concern for sustainable development objectives. The traditional design process in which the architect, in taking the brief from the client, also takes the lead in introducing new ideas, persuading others to adopt them from the beginning and to follow them through to later stages of construction, is no longer valid. The traditional system of authority in the construction industry no longer holds. One of the most fundamental aspects of design authority, that of setting the aims of the project, seems to have been dispersed amongst the actors and over the life of a project. The move towards sustainability in building design seems to imply that architects, in France as well as in Britain, can no longer be certain that they will set the agenda for their work.

### **The environmental assessment methods**

As is clear from the text of this chapter, the development and the use of evaluation methods is highly dependent on the national context. The environmental management system (EMS); is specific to HQE approach in comparison to BREEAM: it comes under the national contexts. The variety of arrangements in the United Kingdom does not allow a single EMS; anyway, the very detailed terms of a building contract built up an implicit management system. Besides, the gap of training between architects (oriented on architectural project) and engineers (analytic skills) in France becomes more necessary a common approach and not only an assessment method. Thanks to HQE, the client forces it on design team members. However, client and designers spend a lot of time to apply a new management system during a HQE certified project, whatever its size. The benefit of a fixed EMS is uncertain for small projects. This could be one of the causes of the HQE certification lower spread than BREEAM.

An other cause is the temporal gap. The first developments of BREEAM began roughly ten years before HQE. Most of these years were dedicated to develop and test the British method. HQE approach benefited of international experiences especially for the environmental specifications, its development stage could be shorter. Even if it is too early to assert, we presume that HQE approach is spreading in France two to three years later than BREEAM has done in the UK. The question is the scope of the asymptote. In the UK and a fortiori in France, certified buildings are currently still a minority among the new constructions. Certification numerous grows both in France and UK. It seems to be probable that the asymptotic scope will be higher than it is today, but different because of the high dependence on the national context.

It is also clear that there are, within these national evaluation systems, a fair amount of freedom for practitioners to select variations in the factors to be measured and the standards to be applied. So a major question is to understand whether the particularities of each situation are so specific that comparison between results is impossible. Are the standards to be achieved in different countries (in this case Britain and France) similar? Or is one national jurisdiction always more exacting than another? To answer this question, it is necessary to know whether the units of measurement are the same (or easily translated) and to determine the answer to this problem, it is necessary to understand where the measurements made are objective and where they are subjective, involving not scientific information but human judgement.

Our case studies, and contextual investigation, show that there is a large element of judgement involved, especially in the UK evaluation systems. There is a choice of aspects to measure and a selection of criteria by which satisfaction or achievement can be determined. The only aspect which is consistently included is that of energy use and the ways in which that can be measured are allowed to vary. There is a possibility that the level of CO<sub>2</sub> emissions will become a universal criteria in the near future, for new building, but this is not normally applied to the operation of the existing stock.

So we come to the broader basis of comparison. Can we say that doing an evaluation is a good thing, and if so, equally good in all national conditions? Those professionals we have interviewed (engineers, architects, surveyors) think so. Almost without exception they have let us know that they thought that working against explicit sustainability criteria was a good thing: something they would do again, whenever professional circumstances allowed (or forced) them to do so. But this does not mean that even using such assessment methods entirely systematically would have truly increased the sustainability of all the buildings we studied. The only real test, in the long term, of the effects of using these assessment methods, is on the results in use of the buildings concerned. More information, about what actually happens in each country in the later stages of use, will be required before this can be fully determined.

#### **Note**

This work was partly financed by a grant awarded by Ministère de l'Équipement (Plan Urbanisme Construction Architecture) to Eric Henry at Laboratoire PACTE Politique et Organisation of Université de Grenoble. Invaluable support was given by Marie-Cecile Puybaraud of Johnson Controls International. Research assistants in the UK were Julie Codet-Boisse and Adrian Boots. In France, team members were Magali Paris (CRESSON-ENSAG) and Stéphanie Abrial. ....

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