Proceedings of Building Simulation 2011:
12th Conference of International Building Performance Simulation Association, Sydney, 14-16 November.

THE DESIGN OF THE CO-OPERATIVE HEAD OFFICE, MANCHESTER

Mike Hitchmough[1], Nigel Holden[3], Mark Johnson[2], David Kingstone[2], Mark Phillip[2],
Nab Speakes[1], and Jim Webster[1]
[1]3DReid Architects, United Kingdom, [2]Buro Happold, United Kingdom
[3]The Co-operative Group, United Kingdom

ABSTRACT

This paper describes how the use of BIM / simulation integrated within the design process for a new corporate office of 30,470sqm NIA for 3,200 people that is designed to BCO 2010 A grade standards (British Council for Offices, 2009), and incorporates a number of innovative low energy features including earth tubes for supply of tempered air, double skin façade; atrium and biofuel CHP, has influenced the design process when working to a very tight programme.

Simulation was used to evaluate the building orientation, the performance of the double skin façade, potential for natural ventilation, optimisation of shading, predicted energy consumption, performance of the earth tubes, chilled beams, impact of exposed fabric, structural design, lift traffic analysis and heat recovery efficiency.

INTRODUCTION

The Co-operative Group (www.co-operative.coop/) is the UK's largest mutual business. The business is ethically and sustainably led. As a result, when the decision was taken to develop a new headquarters building to bring all of its head office functions under one roof – there was no option – this building had to be a clear demonstration of the sustainability goals set out in the organisations sustainability governance; whilst being commercially delivered. In UK terms this means that it must be designed to be BREEAM Outstanding (www.breeam.org), Energy Performance Certificate A Rated measuring the building design carbon efficiency (REF) and Design Energy Certificate (DEC) A Rated building (http://www.communities.gov.uk/documents/planningandbuilding/pdf/998942.pdf) measuring the in use carbon efficiency.

The majority of commercial projects are constricted by a 'circle of inertia' (http://www.carbontrust.co.uk/Pages/Default.aspx) Carbon Trust) where market barriers between the members of the development team make the business case for a low carbon building untenable. However, in this case, the traditional barriers do not exist as The Co-operative is the owner, developer, tenant and funder of the project. And while not a unique situation, this allowed the project to develop in an inclusive and collaborative manner.

THE CLIENT'S BRIEF

The brief issued by the client to the design team in 2008:

- 30,000sqm (Net) High quality specification offices in Manchester City Centre
- Minimum of 5,000 sqm expansion space
- Minimum of 2,000 sqm floor-plates
- Located close to a mass transport hub
- The building will minimise energy consumption (The Co-operative Group Target 25% reduction on existing consumption by 2010)
- The building will achieve BREEAM Outstanding
- The building will optimise the use of renewable energy sources for heating, cooling and lighting
- The building will be carbon neutral and will identify strategies to achieve zero carbon by 2015
- The building must be designed to have the ability to 'plug-in' to, or provide, future innovative energy solutions such as district heating systems, ground source heating systems, connection to an Energy Service Company
- The building should be completed ready for occupation by 2012

This brief was subsequently developed by the design team in conjunction with the client over the following months. In addition to the requirement to achieve BREEAM Outstanding and in order to measure the energy / carbon performance of the building in accordance with industry standards, EPC A and DEC A ratings were selected.

In addition to the EPC, DEC and BREEAM targets, the client also required the building to have an in use total equivalent metered energy consumption of 150 kWh/m^2.

Energy performance figures for offices are based on ECON guidance which is now 15 years old. The UK Green Building Council have produced a report which consolidates these figures against modern building performance. The uplifted targets for best practice are as follows (expressed as kWh / m^2):

	Fossil	Elec
Naturally Ventilated	58	54
Standard Office (AC)	71	128

Due to the potential mixed mode nature of the building we were to aim between best practice for naturally ventilated and air conditioned offices. Note that these figures are the net energy consumption of the building including renewables.

THE DIFFERENCE BETWEEN DECS AND EPCS

These two ratings indicate different aspects of a building's total carbon emissions performance. A Display Energy Certificate (DEC), (or operational rating), records the actual CO_2 emissions from a building's energy use over the course of a year, and benchmarks this against buildings of similar function. An Energy Performance Certificate (EPC), (or asset rating), models the theoretical, energy efficiency of a particular building, based on the performance potential of the building as constructed and commissioned (the fabric) and its services (such as heating, ventilation and lighting), compared with a benchmark calculated utilising a simplistic calculation methodology. The building quality (the EPC) has a large impact on the total emissions (the DEC), but does not explain all of the actual emissions. Other factors such as unregulated loads (e.g. IT, plug-in appliances), building user-behaviour, and impact upon emissions, are reflected in the DEC.

The operational rating of a building is also greatly influenced by the effectiveness of the commissioning of the key systems and components. This affects the accuracy of the EPC against the measured consumption data of the building services systems. To counter this risk, the building contract was set up to ensure that the commissioning process is correctly managed and that enough time is allowed within the programme to ensure effective set up.

As the rating that captures all actual CO_2 emissions, the DEC is the most important rating. However, in order to understand what is driving these emissions, the EPC is critical in separating the influence of building quality from other influences such as end user behaviors. However, to truly understand the energy used, and carbon emitted from a building, both certificates are required.

Introduced by the UK Government in 2008 as part of the implementation of the EU's Energy Performance of Buildings Directive, currently only large public sector buildings are required to have a DEC, whereas all buildings require an EPC upon construction, sale or lease. As part of the early brief development The Co-operative took the decision to achieve both EPC A and DEC A ratings to reflect their sustainability governance.

BREEAM

BREEAM (the Building Research Establishment's Environmental Assessment Method) has become the industry standard measure of a building's environmental performance in the UK.

BREEAM Outstanding rating was introduced in August 2008 to recognise a new standard of sustainability for exemplary developments. A score of 85% must be obtained to achieve Outstanding, compared to 70% for an Excellent rating. The project is targeting the highest score awarded for outstanding to date.

THE DESIGN PROCESS

Due to the requirement to have the building ready for occupation in 2012, in conjunction with the high sustainability / carbon targets for the performance of the building and the tight budget, the design team worked closely together with the client team. The main client sponsor had specified during the earliest workshop sessions that the building technologies proposed for the building should not be cutting edge and unproven – rather design strategies based on 'pragmatic innovation' should be adopted in order to ensure that the building meets the rigorous requirements of a BCO Grade A office (British Council for Offices, 2009), whilst achieving the highest environmental standards.

The design team worked as an integrated group with all disciplines encouraged to contribute to an accelerated design development programme through the use of a workshop based approach. Buro Happold undertook all simulation of the project.

Following the development of three options for presentation to the main board of The Co-operative, a preferred option was selected in May 2009. The key elements of the proposed design were:

- Central ventilation via earth tube and atrium
- Exhaust ventilation via the facade
- Optimized building form
- Double skin façade
- CHP as appropriate low carbon energy technologies
- Exposed structural concrete slab in conjunction with steel frame to provide thermal mass
- Chilled beams for heating and cooling on office floorplate
- Air handling on upper floors
- Daylight / reduce solar gain control

- Water efficiency plus rainwater and gray water recycling
- Building management system.

Although the building form and the proposed systems were regarded as leading edge, the design only achieved BREEAM Excellent, DEC D & EPC A. The primary reason behind this is that to realistically achieve a BREEAM 'outstanding' rating, the building is essentially required to be 'Carbon neutral' with energy offering a lot of highly weighted assessment credits. In a modern office, the predominant primary energy resource requirement is power. Therefore a low / zero carbon source of electricity is required.

To meet the demands set for the project of low carbon and highly efficient design, the original model needed to be taken to a more detailed level to include actual plant selections, firm operational strategies and test alternative design options. The targets presented of designing the services to achieve BREEAM Outstanding, EPC A and DEC A involve a number of layers of processes. These include:

- Constructing the geometry of the model
- Agreement of initial design parameters of maximum occupancy with overall diversity
- Selection of methods of calculation
- Steady state load calculation
- Selection and sizing of plant
- Detailed challenging and setting of building management operational strategies and then reselection of plant, which will dictate the way the building will be operated by the client.

However whilst the above pushed the design closer to the targets, the application of Biofuel CHP really unlocked the potential to deliver a 'carbon neutral' building.

DESIGN TOOLS USED

To achieve the predicted energy and emissions targets in operation, it is necessary to understand the partnership required between the design and construction processes, and building users and operators. This relies on state of the art energy efficient design, installation and commissioning with attention to detail, and a client willing to understand and convey how the building should be operated in order to meet the needs of the building users.

At the start of the project it was agreed that the structural, M&E and architectural models would be co-ordinated using Building Information Modelling (BIM) software (www.usa.autodesk.com/building-information-modeling). Autodesk Revit (www.usa.autodesk.com/revit-architecture/) was selected as the engineers had used Revit previously, having pioneered it in their New York office but this was the first project that that architects had used it. At the outset of the project a collaborative project extranet was envisaged, that was to be sponsored by the client however the reluctance of the quantity surveyor to adopt BIM and the insistence that hard copy drawings were issued in a traditional manner diluted the practicality of a coordinated digital based approach.

Due to the fact that the team had to generate three design concepts simultaneously over a three-month period the team only started using the BIM software once the final scheme was agreed in May 2009. It was quickly established that the MEP elements of the software were not suitably advanced to make it feasible for the M&E engineers to use the BIM software as the main tool linked with simulation in the development of the environmental concepts. This combined with the impact of the accelerated design programme upon the planned training of staff for the software the decision was made by the team that the most effective way of utilising BIM was for the coordination of Architectural and Structural elements due to the complexity of the geometry of the building and the intricacy of the double skin façade and atrium roof structure.

As no single software package was sufficiently sophisticated to enable analysis of all the different heat recovery strategies and processes. Therefore multiple methods were used to calculate each process and to simulate the building operation. The process adopted by the design team with the aid of design and simulation tools are detailed in the following sections.

ENERGY & EMISSIONS ANALYSIS

The initial target of achieving an EPC A could be achieved with an efficient building design in conjunction with a significant proportion of heating delivered by a biomass boiler. However, the total (including small power use) building energy consumption target of no more than 150kWh/m^2 was much more difficult to achieve. This was further compounded by the introduction of two floors of Contact Centre Staff (600 people) with extended operating hours into the brief requirements as part of the brief development. The energy model and subsequent analysis indicated the following factors were important:

- Lighting energy – efficient lighting and perimeter daylight dimming on the double façade and atrium sides, contributed to reducing the need for artificial lighting, however, decorative feature lighting and the additional fittings necessary to create an aesthetically acceptable layout was found to result in increased energy consumption. Thus, a need for further work on the final design and selection of luminaires was identified.

- Heating energy consumption was predictd to be significant. Difficulties in achieving direct heat recovery to the lower floors office ventilation system exacerbated the problem. Work was therefore instigated on the use of heat rejection from the building's cooling systems.
- The IT strategy was investigated and the benefits of thin client computers as well as realistic energy consumption from server rooms were identified. The trend in office IT strategies in recent years has been a year on year increase in electrical energy consumption, showing the importance of emphasis on energy efficient IT purchasing and operation policies.

The office DEC rating scale is set irrespective of office type (naturally ventilated or air conditioned, small low tech office or large headquarters) at 100 (boundary between a D and an E rating) which is representative of a typical small naturally ventilated office (CIBSE Guide F). A standard air-conditioned (type 3) or prestige office (type 4) designed and operated to a good practice level may only achieve an F or a G rating respectively (CIBSE Guide F) (Figure 2). Looking at a sample of representative offices it was found that recently completed headquarter buildings were achieving E and F ratings. For the proposed building and its efficient design, a D rating was found to be achievable.

In order to deliver a DEC A rating it was clear that the generation of electricity from a low carbon source was necessary. This resulted in the development of a strategy utilizing electricity led CHP that also delivered heat for building heating, hot water, and absorption chilling.

It should be noted that all of these elements reduce the carbon emissions whilst increasing the building energy consumption.

The importance of the above decisions were demonstrated using a purpose built interactive energy and emissions tool that manipulated the energy model analysis to demonstrate the effect that strategic design decisions had on energy consumption, building emissions, and the cost of energy. This enabled the design team and client to make informed and balanced decisions on overall strategy to meet the conflicting aspects of consumption, emissions and cost.

DAYLIGHT AND FAÇADE DESIGN OPTIMISATION

The first stage in terms of building optimization involved the passive elements of the design: maximising the potential for natural light, optimizing natural ventilation, and minimizing building heat loss.

In order to determine the optimum façade design, we analysed the building performance for comfort and energy consumption with a view to maximizing available daylight whilst controlling solar gain in order to take advantage of free cooling when available, while avoiding resultant excessive cooling requirements in summer and maintaining beneficial free heating in winter.

The constraints of the site and the required office accommodation dictated a deep plan building. This immediately presented problems in terms of achieving the good levels of natural lighting, recognised as important for occupant comfort and to minimize the use of artificial lighting. The form of the central atrium was therefore immediately highlighted as critical to achieving the desired daylight levels. IES virtual environment (http://www.iesve.com/) was used to compare both the availability of natural light (Radiance) and room heating, cooling, and lighting demand (Apache). This approach was an enhancement to the LT method [BRECSU, 1994] that measures relative energy consumption of building form.This allows for the assessment of more complex geometries such as the double skin façade.

The double façade was shown to marginally increase cooling demand, particularly towards the top of the building as a result of solar gain increasing the temperature in the double facade. Mixing and circulation of air within the double façade was shown to occur so that the middle floor has the most frequently occurring warmer temperature. This mixing was later shown in more detail using CFD modelling.

To ensure all major comfort parameters were met within the building, glare through the façade and atrium roof was analysed using IES software. The following methodology was followed:

1. performing computer simulation modelling to identify where and when direct sunlight on the office floor plate occurs
2. running computer analysis to review the extent of glare when it does occur, to determine if it will be an issue to occupants of the building
3. summarising the extent of the problem graphically so that it can be determined which

areas of the building require remedial measures to reduce or prevent glare

The potential variations in time and location of glare incidence are almost limitless. Therefore in order to maintain a reasonable level of analysis the simulations were limited to the following scenarios:

- Winter solstice - December 21st representing the lowest angle daily sun path
- Summer solstice - June 21st representing the highest daily sun path
- Mid season - March 21st representing a medium case

All other times will fall between these extremes and can therefore were approximated by the analysis.

The results form this analysis demonstrated that the building occupants will suffer discomfort for large portions of the year if the glare is not addressed. Therefore options were considered for glare mitigation as follows:

1. dealing with the issue at source – e.g. micro louvers at roof level, hanging banners within the atrium
2. dealing with the issue at a local level – e.g. blinds

For each of the solutions that were proposed an analysis of their effectiveness was carried out which included:

- effect on ventilation air flow
- effect on artificial lighting
- total effect on energy consumption
- user operability

Aesthetics and design impact were also considered to derive at the chosen solution(s).

VENTILATION STRATEGY OPTIMISATION

The deep building plan and the close proximity of the Manchester inner ring road meant that a fully naturally ventilated solution would not be possible on its own. It was therefore decided to develop an energy efficient mechanical ventilation system that was responsive to the levels of building occupation. One way of creating a low energy ventilation system is to minimise ventilation system length and pressure drop. This gave rise to the following questions:

- Could we utilise the central atrium and double façade as supply and exhaust air paths respectively?
- Could we deliver adequate fresh air to all the office floor plates?
- Would comfort adjacent to the double façade or the edge of the atrium be compromised?
- Could we avoid the use of exhaust fans?

For the chosen building form, we developed a detailed dynamic thermal model dividing the office open plan floor plates into three (external, internal and atria office) spaces, incorporating openings so that air flow was allowed between from the atria, to each office floor plate, into the double façade, and out at the top. Tempered fresh air was then delivered into the atrium mechanically.

Dynamic thermal analysis was performed for each hour of a complete year in conjunction with a computational fluid dynamics analysis of the winter and summer design conditions. This raised the following issues that had to be addressed:

- air was shown to enter the double façade on the windward side, through the office space and out through the double façade on the leeward side. The effectiveness of this was reduced by subdividing the double façade vertically into 6 separate sections. However this approach was necessary to satisfy the fire engineering strategy that was adopted;
- a reversal of airflow, back from the double façade and into the office was shown to occur from upper unoccupied floors to lower occupied floors (this occurred during the evenings where the call centre was occupied outside of the normal working day). Introducing automatic control of the opening of vents into the double façade resolved this;
- there were predicted instances of airflow was reverse. This was resolved with the use of the double façade exhaust fans during these times;
- how fresh air was introduced into the base of the atrium was shown to be critical in maintaining draught free conditions at the atrium floor level and maintaining an even temperature distribution within the atrium adjacent to all of the open office levels. It was concluded that the final design of the supply air diffusers would need to be carefully considered and would need to be adjustable to allow for adjustment during building commissioning.

At this point it was felt that the strategy was becoming complex and a complete review was carried out within the team to ensure that the original design focus including simplicity of operation and energy targets were not being compromised.

Out of the review exercise, additional key issues were raised as follows:

- double skin condensation – caused as a direct result of air being discharged into the double skin void. Buro Happold produced a condensation analysis report, based on which indicated condensation as a risk – BAM highlighted considerable additional risk monies against this, which focused greater attention to the issue within the client team.

- atrium air delivery system – development of the system detail required extensive bulkheads which impinged on the aesthetics of the atrium
- Openings from the office into the double façade resulted in the need for a complex smoke clearance system to avoid floor to floor spread of fire and smoke.

As a result of the review a more traditional simplified strategy was adopted where fresh air was ducted to each floor plate and introduced via the raised floor void, exhausted via the atrium. This enabled the double façade to be significantly simplified, removing the need for double façade smoke exhaust fans, automatic controlled ventilation openings to the office space. This was at the expense of an increase in the supply fan energy consumption.

EARTH TUBE AIR DELIVERY SYSTEM

A potential BREEAM credit could be realised if the building design ensured that air intake terminals were at least 20m from sources of pollution. From precedents visits undertaken by the team to see similar projects in Germany (Prisma Building,) we were also aware of the passive benefits available from the use of earth-to-air heat exchangers in the form of 'earth tubes'. The use of earth tubes therefore presented an attractive proposition provided that both objectives could be realised.

An earth-to-air heat exchanger draws ventilation air through ducts buried underground. The temperature of the ground below a depth of 3m remains at a relatively constant temperature, dampening and delaying fluctuations in ambient air temperatures. This temperature is higher than the ambient air temperature during the winter and lower during the summer, providing opportunities for space conditioning throughout the year, with the air being pre-heated in winter and pre-cooled in summer. The performance of coupling a building with the earth is dependent upon:

- the depth below the earth;
- length and cross sectional area of the air path;
- soil properties;
- velocity of the air.

To identify the optimum sized earth duct, four different configurations and 3 different lengths were analysed with respect to the above criteria. The first two configurations are straight earth ducts and the second two configurations create a labyrinth within the earth duct.

The performance of the different configurations was simulated using validated IES modelling methods (Warwick et al, 2008). The performance was then presented for each option in terms of peak heating performance in winter, saving in annual heating energy (in terms of energy and cost), peak performance in summer, saving in annual cooling energy (again in terms of energy and cost), this was then presented alongside the additional pressure added to the system as a result of passing the air through the earth ducts and the additional annual fan energy (again in terms of energy and cost).
The optimum earth tube design utilised three number separate tubes each rated at a third of the total air flow volume. Whilst longer earth tubes gave increase energy benefit, economically any more that a 30m long earth tube proved financially unviable. However the final installed solution includes earth tubes at varying lengths form 30m to 60 m due to constraints for the location of the inlet positions within the public realm to the South of the building.

In summary the earth tubes have been assessed to contribute an estimated 2250 kWh of cooling and 9500 kWh of heating per annum with a combined total carbon saving of 2300 tonnes (assuming displacement of gas fired heat)

MECHANICAL SYSTEMS OPERATIONAL DESCRITPION

The following is a summary schedule of the system control used to optimise the mechanical systems for minimising energy use:

1. Minimise Heating and Cooling Loads

- Control the facade efficiently to reduce heat losses and gains
- Manage and monitor all MEP services energy uses and operations
- Operate low energy lighting Control to reduce electrical energy and gains
- Control ventilation efficiently using VAV control from CO2 sensing
- Monitor all energy consumption to aide maintenance of thin client values and good practices.

2. Cooling Priorities

- Maximise free cooling from the earth duct.
- Use the fresh air in the Earth duct and Roof AHU coils to produce chilled water.
- Maximise Cooling recovery using run around coil on roof AHU.
- Maximise free cooling via the cooling towers

- Mechanical cooling up to 500kW will be provided by the absorption chiller with heat from the CHP.
- Mechanical cooling will be provided as the cooling load increases above 500kW and up to 3600kW by sequentially enabling hydrocarbon chillers
- Dehumidification of fresh air will be provided only when needed

3. Heating Priorities
- Maximise the transfer of internal heat gains to the incoming Fresh air using warm chilled water return circuit.
- Heat Recovery from CHP intercooler
- Heat Recovery from Air systems, air to air , water to air and water to water
- CHP lead heating source
- High efficiency gas fired boiler plant

4. CHP Priorities
- Production of Electricity
- Recover and transfer intercooler heat to heat the incoming fresh air in AHU 1
- Recover and transfer CHP waste heat heating supply to heating buffer vessel via HX1
- Utilise heat in heat in the Buffer vessel for building heating loads
- Utilise heat in the Buffer vessel for building DHWS load
- Utilise heat in the Buffer vessel for heating source for the Absorption chiller

5. Dehumidification Priorities

Modulate the set point of the chilled water from the propane chillers as required to meet demand by maintaining highest flow temperature possible based on ambient wet bulb to maintain the highest COP possible.

This controls philosophy formed the basis of the energy simulation input data and is it is critical to understand this control routine before an accurate energy assessment can be made.

MECHANICAL SYSTEMS DESIGN OPTIMISATION

Further Enhancements required to achieve BREEAM Outstanding, DEC A were waste heat linked to the absorption cooling, bio-fuel as the CHP fuel source (this is being grown on the land that is farmed by The Co-operative) and the increase in the size of the CHP plant to facilitate the provision of excess power to the grid.

The design process continued with the appointment of the contractor. Key areas for development since that appointment have included:

- Integration and control of the mechanical systems, seen as a vital part of the final design, has influenced the final sizing and procurement of plant. Applying the selected plant data to the energy prediction model has resulted in a change to the plant pressure drop and pump operation to achieve the DEC target. Optimization of system control routines to ensure maximum operating returns are realized
- Continual monitoring of client changes and analysis of these effects on the predictive DEC modelling.

As the design has developed the Revit model has evolved to incorporate the architectural and structural elements, which has proved very effective in the coordination of such a complex building. The detailed M&E services design has been developed using the shared model that has led to an increase in the efficiency in the use of plant-room spaces and coordination of builders work with structural elements. Clash detection functionality within the software allows the designers to quickly identify where there are potential problems and amend this before it is constructed. The ability to quickly derive quantities of any element has allowed the team to monitor the steelwork tonnage for the building when testing alternative design solutions that provides real information to support design decision-making. The coordination of subcontractor information such as double skin façade, concrete coffer units, structural steelwork, and atrium roof has been simplified. BIM has accelerated the detail design process has significantly improved communication between professional disciplines, manufacturers and contractors.

It should be noted that at the time of writing, detailed design work is still ongoing and further refinements are being made, but the development of the project remains firmly on target to achieve the key briefing requirements as set out in the introductory section of this paper.

LESSONS LEARNED AND FUTURE WORK-STREAMS

Throughout the process, the design was developed, tested, refined and then proved though detailed analysis. This feedback loop required a disciplined approach from the team but did allow the development of some robust analysis techniques and outcomes.

Some of the key outcomes from this process are as follows:

- An understanding between design team, constructor and client and an acknowledgement of the effect that their decisions have on the energy efficiency of the building is required.

- The whole process is iterative and requires regular review of the assumptions made in the original concept model to ensure that the results meet the contract targets.
- The importance of the client's energy efficient IT strategy has to be recognised. Power consumption through IT equipment is increasing and can offer a large contribution to the building's energy use. Modelling analysis tools are vital in demonstrating this.
- The importance of energy efficient lighting, display lighting, and control design cannot be underestimated. Minimising cooling and heating loads increases the significance of the importance of the efficient design and operation of artificial lighting.
- The selection and control of water-side equipment (heating, chilled water, and heat recovery systems) has a significant impact on building energy consumption in terms of minimising system pressure drop and allowing more efficient low load operation.
- Modelling of a double skin façade requires a more detailed analysis than might be necessary for a 'standard' envelope – in order to aid understanding of the contribution that this will (or will not) make to the internal environment.
- The use of BIM has limitations currently in terms of energy analysis. There are also limitation with the interoperability of BIM and other analysis tolls such as IES meaning that the 'single model' for all disciplines to utilise for design and analysis is, in the author's opinion, is not yet a reality.

The occupation of the building will trigger the initiation of the post occupancy review period. The feedback from the 'in use' system performance will be used for comparison against the modelling analysis techniques and results.

It is the intention that this data will be used to calibrate the analysis techniques to ensure future use of modelling is as accurate as possible.

Finding a use for the excess heat generated by the CHP must be explored. In the case of this project there is potential for connecting to the surrounding future developments in the wider masterplan. The opportunities to further enhance the sustainability of the development are wide-ranging and a coherent and focused strategy for this will be developed.

The recent UK Government announcement (Government Construction Strategy, May 2011) that interoperable BIM is required to be used in the design and procurement of all new public buildings from 2016 will ensure that uptake of BIM is accelerated and potentially enable building performance modeling to be fully integrated within the design process from the concept design stage through to building operation. (J. A. Clarke, Energy Simulation).

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For schematics of the building and to view site progress photographs please visit:-http://www.co-operative.coop/estates/Developments/New-Head-Office/