Technology Strategy Board
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Energy Efficient Whitehall: Strategic Brief

1.0 INTRODUCTION

1.1 Purpose of the Strategic Brief

The purpose of this document is to brief applicants at the initial stage of the competition. At this stage, it is impractical for large numbers of people to visit the buildings concerned and investigate them directly. Consequently no visits or contact with the incumbent organisations will be considered until later in the competition.

Sections 2, 3 and 4 of this document describe the current situation at the host buildings. Section 5 provides the energy-related themes and Section 6 some constraints to consider. Some readers may wish to turn to Section 5 first to understand the opportunities, and then read the other sections to gain greater insight.

1.2 Competition background and aims

Mandatory Display Energy Certificates (DECs) for public buildings were introduced in 2008. They have highlighted the challenge for Government to improve energy efficiency across its office estate whilst also using its buildings more intensively. Reductions in energy use and carbon emissions are now underway, using largely well-known technical and management measures. The government now seeks innovative approaches to reducing the energy requirements of the civil estate, that are replicable to other public and commercial buildings, and that help to develop approaches, skills, systems and products that will benefit UK businesses at home and overseas.

The competition calls for innovative retrofit solutions to reduce energy use and carbon dioxide emissions within government office buildings. The emphasis is on demand-side measures, especially for those occupiers who rent their premises and who are in close communication with their landlords and agents. Low-carbon energy supplies and connections to district heating systems are outside the scope of this project.

1.3 Approach

Pilot interventions will take place in four host buildings occupied by 'Whitehall Ministries' and accommodating Departmental headquarters operations. Owing to their function, construction, heritage and high-profile location, offices like this are often regarded as difficult to treat in terms of energy efficiency. In reality they bear similarities to other office buildings and offer many opportunities.

The four occupier departments and their building and facilities managers are already working to improve energy efficiency and are achieving significant savings. Successful applicants will enter into contracts with TSB on behalf of the occupiers or owners of the host buildings. They will be required to collaborate closely with each department including building owners, landlords and incumbent facilities management contractors. There must be minimal disruption to business, both while the competition works are being implemented and while their performance is monitored on site.

Applicants should submit applications that focus on innovative approaches, systems, techniques and technologies. It is important to show how proposals relate to the themes described in Section 5, and their likely suitability for one or more of the four host buildings. Applicants must show that their proposals will have a lasting effect and be suitable for replication across other government and commercial offices in the UK, and if possible beyond.

1.4 **Innovation and replication**

Adopted innovations will form a package of carefully selected measures to be retrofitted whilst each building is fully occupied. With the large number of leasehold properties across the Government estate, there is particular interest in interventions that can be initiated by tenants. Landlord's services are also within scope, especially for better control and management, but will need to be considered on a case-by-case basis. Limiting retrofit proposals to 'internal-only' solutions means that lengthy statutory approvals usually associated with works to improve a building's fabric may be avoided, especially for the two listed buildings included. The following sections outline the buildings, their environmental services, and their energy use. They suggest themes for innovation and identify possible constraints.

1.5 **Assessment criteria**

Assessment criteria for innovation include:

- Predicted energy reduction and carbon savings per pound spend on a lifecycle basis[1];
- Well-integrated solutions with ability for replication;
- Proposals for monitoring the effects of the innovations, especially for energy saving while taking account of human aspects;
- Use of renewable and low-impact materials and processes where possible;
- Minimising disruption to allow business continuity during retrofitting; and
- Ability to work to the competition timeframes.

1.6 **Summary**

The aim of the competition is to identify innovations in techniques and technologies that show the greatest promise in providing a step change in office energy use within four host Whitehall buildings. Proposals need to be generic enough to be widely replicable across the Government estate and beyond, but specific enough to apply to at least one of the four host buildings. Some (e.g. those associated with central control, monitoring and management) may affect the energy use across the whole building, while others (e.g. alterations to lighting, office equipment, windows or room controls) may be demonstrated in a small part of the building. All proposals will need to take into account ongoing landlord, tenant and facilities management arrangements and end user criteria. Other constraints we have been able to identify are offered for general guidance at the end of this document.

[1] This criterion includes the Government's concern to obtain best value from its spending.

2.0 HOST BUILDINGS

2.1 The four buildings chosen as hosts for the competition are identified below. Some key characteristics are summarised in Table 1 overleaf and in the following text.

Building 1: Department for Business Innovation and Skills (BIS), 1 Victoria Street
BIS creates the policy critical to grow the economy, from higher education, skills and science to innovation, enterprise and business.

Building 2: Department of Communities and Local Government (CLG), Eland House, Bressenden Place
CLG sets UK policy on local government, housing, urban regeneration, planning and fire and rescue. It has responsibility for all race equality and community cohesion related issues across Great Britain and for building regulations, fire safety and some housing issues in England and Wales.

Building 3: Department of Energy and Climate Change (DECC), 3 Whitehall Place
DECC is responsible for all aspects of UK energy policy, and for tackling global climate change on behalf of the UK. In 2008 the building was sub-let to DECC by DEFRA, which remains the head leaseholder.

Building 4: Foreign and Commonwealth Office (FCO), King Charles Street
FCO is the government department responsible for promoting British interests overseas and supporting our citizens and businesses around the globe.

Table 1: The host buildings compared

	BIS 1 Victoria Street	**CLG** Eland House	**DECC** 3 Whitehall Place	**FCO** King Charles Street
Date of construction	1960s. Major renovation completed in 1995	Mid-1990s, with phased occupation between 1996 and 1998	1950s. Interior completely rebuilt behind existing facades in 2003-04	19th century with later additions and alterations
Net Internal [2] Area (NIA) sq m	31,133 sq m	23,237 sq m	8,768 sq m	39,103 sq m
Building footprint	Distorted 't' shape	Compact, deep plan	Slightly tapering solid rectangle	Rectangle wrapped around central and adjacent courtyards
Storeys *(above + below ground)*	9 + 3	10 + 1	8 + 2	5 + 2 *plus mezzanine* High ceilings
Construction features	Concrete frame, granite cladding. Insulation added when renovated.	Compact form in concrete and steel with curtain walling.	Stone-clad masonry shell with cavity, new secondary glazing, new interior lining + cavity insulation.	Grade 1 Listed. Solid masonry walls. Single-glazed timber windows.
Office floor-plates *(facade to facade or atrium for CLG)*	18 metre deep open-plan.	20 metre deep open-plan around two large atria.	22 metre deep open-plan, slightly tapering.	18 metre deep mainly enclosed cellular offices.
Occupancy FTEs *(Full Time Equivalent staff)*	2,200 and rising - 8 desks per 10 FTEs.	2,300 7 desks per 10 FTEs in places.	1,150 Sharing 800 desks	1,934
Insulation	Walls: internally insulated U=0.45 to 0.6. Roof: U=0.45 W/m^{2}K.	Aluminium curtain walling, Average U-value 1.4 (glass, frames, panels).	Walls: internally insulated U=0.45 to 0.6. Roof: U=0.3.	Largely uninsulated.

[2] Source: Electronic Property Information Service (e-PIMS) 2009, the central database of government civil estate properties and land.

	BIS 1 Victoria Street	**CLG** Eland House	**DECC** 3 Whitehall Place	**FCO** King Charles Street
Windows and glazing	External timber, single glazed. Internal aluminium secondary double-glazing. Blinds between. U=1.65.	High performance double-glazing Spec varies with position including low E and heat reflecting U=1.6.	Steel, single-glazed opening + Aluminium secondary glazing. New double-glazed metal windows to ext-ensions. Both U= 3.0.	Original single-glazed hardwood windows need to be retained.
Main HVAC systems	Mixed mode: under-floor air + chilled ceiling. Windows have trickle vents and can be opened	Under-floor air + chilled ceilings and chilled beams.	Ceiling 4-pipe fan coil units with primary tempered fresh air ducted to the units.	Naturally ventilated. About one quarter of area is mechanically ventilated or fan coil cooled.
FM contract	E C Harris and Cofely, to 2012.	MITIE. Contract runs to March 2011.	Interserve, 15-year "sustainable workplace management" contract from April 2009.	Interserve, 7-year contract from December 2008.
Energy advisor	E C Harris	N/A	Briar Associates	N/A
Recent and planned occupancy changes	Fluctuating occupancy (due to building merges) and likely to rise as the BIS estate is consolidated.	500 occupants (350 desks) added in mid-2009.	Refitted for DECC In 2008-09. Occupancy is much higher than Defra's in 2008, and is still rising.	Rising occupancy and new system adding about 800 computers.
Tenancy *(all single occupier)*	Rented	Rented	Rented by DEFRA and sub-let to DECC.	Government-owned

2.2 **Commentary**

These buildings have not been selected to represent the entire range of office types across the government estate. However, similarities and differences in their construction, servicing, fit-out and use provide sufficient opportunity to demonstrate a variety of innovative, generic solutions that may open the way toward replication across the wider government office estate. The FCO is the only government-owned building. The other three are commercially owned and with the Government as sole tenant. Applicants must bear in mind when submitting proposals that landlord permissions may be required before certain types of intervention can be implemented.

All four buildings exhibit the trend in government offices towards more intensive use of space through higher occupancy levels, longer operating hours and increased desk sharing. They also feature relatively deep office floor plates requiring extensive use of artificial lighting. All contain restaurants and server rooms of various sizes. The trend to more intensive use and servicing common across the estate makes good building and facilities management services increasingly critical in looking after these buildings and their occupants and to control their energy use. All incumbent Departments are supported by ongoing FM contracts. Two of these, BIS and DECC, also retain the services of consultants to advise on ongoing energy and carbon-saving programmes.

Three of the buildings were built or substantially reconstructed within the last fifteen years and include new mechanical and electrical services, suspended ceilings, recessed lighting, and upgraded wall, window and roof insulation. These now provide modern, commercial standard, mechanically ventilated and cooled, open-plan office space, with adjacent enclosed rooms for meetings etc. The fourth building is the Foreign Office in King Charles Street, which is of traditional construction and different in many respects from the other three. A description of the host buildings now follows in the order of decreasing size.

2.3 **FCO - King Charles Street**

Built in the 19th Century the accommodation at King Charles Street is arranged around a large central quadrangle with four smaller enclosed quadrangles at the corners. The one at the SW corner has been glazed over to provide protected semi-outdoor space.

The building's cellular accommodation, generous circulation and grand reception rooms give it a lower net to gross floor area ratio than the other three buildings. Despite this, at 39,100 sq m, its Net Internal Area (NIA) is much the largest of the four, although the number of full-time equivalent staff (FTEs) at both BIS and CLG is greater. The ground, first and second floors have very tall ceilings, averaging about 5.5 metres. Its Grade 1 Listing imposes constraints on alterations e.g. to its single-glazed timber sash windows, which give rise to high levels of heat loss and solar gain. In spite of all this, both technically and in terms of its listed status, King Charles Street is not without its peers in other government buildings, so there is replication potential for suitable innovative measures.

Internally, the King Charles Street building has a history of ad hoc development of both space and services. Still predominantly naturally ventilated and with hot water radiators, over time it has accumulated a variety of mechanical and electrical systems, with a ring main of heated and chilled water in the basement. It also has eight utility electrical intakes, where the other buildings have only one. About 15% of the space is mechanically ventilated (with cooling to some meeting and reception rooms), while another 12%, mostly the top floor, retains its natural ventilation but has fan-coil supplementary cooling on a separate chilled water system.

2.4 **BIS - 1 Victoria Street**

Built in the 1960s on a long narrow site, the building footprint is a distorted T-shape with a long north facade along Victoria Street. In 1993-95, the owner and government occupier collaborated to undertake a major renovation that upgraded the original shell and stripped back the service cores to provide more usable space. Mechanical plant was relocated to the roof, releasing basement space for a conference centre with a capacity of 600 and a restaurant with 180 seats. Ground floor extensions were also added to provide separate entrances for the offices and the conference centre. Overall, the NIA was increased by 21% to the current 31,100 sq m.

The mid-1990s renovation aimed to produce a low-energy building. Walls were insulated internally to a design U-value of 0.45 W/m^2K and a mean U-value for solid elements of 0.6. The hardwood windows were refurbished and double-glazed sealed secondary glazing was added internally, giving the window assembly a U-value of 1.65 W/m^2K. Motorised Venetian blinds were fitted between the primary and secondary glazing. These were originally automated, but this led to complaints from occupants. They are now largely controlled manually, with defaults of 'up' in winter and 'down-and-open' in summer being restored from time to time when the building is unoccupied.

The office HVAC system uses a mixed-mode strategy. Small trickle vents at the heads of the secondary-glazing units provide background ventilation, with additional user-adjustable trickle vents at transom level. For added natural ventilation, and for pressure relief at the higher rates of mechanical ventilation, the BMS can open dampers on each floor, which connect to vertical shafts that run up to outlets on the roof. During working hours, fresh air is also provided mechanically through the floor, at air change rates of between 0.1 and 3 per hour, depending on damper and variable speed motor settings. The BMS measures temperature, relative humidity and CO_2 levels in seven zones and works to optimise the system, including night cooling. Chilled-water cooling is by pipes laid into the metal ceiling panels for about 35% of the ceiling area. Heating is by hot water radiators.

2.5 **CLG - Eland House**

Eland House is the only host building that was designed to be energy-efficient when it was first constructed. Built by its existing owner as a pre-let for government and occupied in phases between 1996 and 1998, it has a compact form with accommodation grouped around a rectangular central atrium and a triangular entrance atrium, including reception and waiting areas. The atria do not have dedicated HVAC systems, but provide the outlet 'duct' for air exhausted from the surrounding offices. Cladding is thermally broken aluminium-framed curtain walling with sealed double-glazing and glass-clad insulated and translucent panels. The average U-value of the

complete cladding system is 1.4 W/m^{2}K.

Energy efficient technical features in the original design included:

- "Intelligent" luminaires, each with individual occupancy sensors and photocell dimmers. These are now in the process of being replaced by similar modern units.
- Chilled beams and ceilings, floor displacement ventilation and variable speed fans.

The original design incorporated a gas-fired Combined Heat and Power generator, to provide electricity and contribute to space heating in winter. In addition to the building's main electrically powered chillers, an absorption chiller was also installed to allow heat from the CHP unit to be used in summer. The system is no longer in use, having never operated as efficiently as anticipated, owing to technical difficulties with the generator and the chillers. Various consultants have assessed the opportunity for reinstatement, but without success. The generator's size is now considered excessive, owing to a reduction in base heat demand following increases in occupancy density and improvements in energy management.

2.6 **DECC - 3 Whitehall Place**

Although substantial in size at 8,800 sq m NIA, this is by far the smallest of the host buildings: the other three have up to five times the floor area and nearly three times as many FTEs. This tapering rectangular building was constructed in the early 1950s as a rear extension to 63-83 Whitehall. In 1970 the whole block was Listed Grade II*. Some eight years ago, the connections between the two buildings (and a third building to the east) were severed, and 3 Whitehall Place was sold. In 2003-04, retaining the existing facades, a property company completely rebuilt the interior. The reconstruction also inserted a small central atrium; added new 6th and 7th floors behind the original parapet, and placed air-handling plant, chillers and pumps on the roof. Walls were insulated internally to U-values of between 0.45 and 0.6 W/m^{2}K. Apart from its listed status, in its size and services, 3 Whitehall Place is more typical of modern government and commercial offices.

As part of English Heritage's requirements, the original single-glazed multi-pane steel opening windows were retained in the refurbishment, and aluminium horizontal sliding secondary glazing was added inside. New windows to the added spaces are in steel and of a similar pattern, but incorporating clear-glazed sealed double-glazing units instead of secondary glazing. The designers estimated the overall U-values of both the new and secondary glazed windows to be around 3.0 W/m^{2}K. Apart from the added roof extension there are no windows on the west side, owing to the adjoining 68-83 Whitehall.

The building has a 4-pipe, fan-coil, air-conditioning system above the suspended ceiling, with discharge diffusers at its perimeter. The system is characteristic of many recent rented office buildings. In addition to the plant on the roof, there is a ventilation plant room on the 7th floor and a considerable amount of constant volume plant (with variable speed motors), which ventilates accommodation on the lower ground and basement floors, where the boiler plant, electrical substation and switch-room, water tanks, sprinkler tanks and water and sewage pumps are also found.

Table 2: Snapshot of energy use and building services

	BIS 1 Victoria Street	**CLG** Eland House	**DECC** 3 Whitehall Place	**FCO** King Charles Street
DEC 2008	130: Grade F	127: Grade F	165: Grade G	[92: Grade D] [3]
DEC 2009	107: Grade E	108: Grade E	150: Grade F	110: Grade E

[3] FCO has eight electricity utility meters. At the time of the 2008 DEC, the data available was incomplete, and readings from the meter supplying the lower ground floor (including some plant) were not included. Taking account of the likely value, the 2008 DEC would have been in the region of 115 (Grade E).

	BIS 1 Victoria Street	**CLG** Eland House	**DECC** 3 Whitehall Place	**FCO** King Charles Street
Electricity trend 2008-2009	13% reduction	6% reduction	9% reduction, *with further rapid falls.*	6% reduction
Gas or heat use trend 2008-09	Falling rapidly	15% reduction	Initial increase owing to building work. *Falling rapidly in 2009-10. See text.*	4% increase (district heat and gas combined)
Heating plant	Gas pressure-jet boilers: two conventional, one condensing, total 3400 kW.	Gas boilers: two at 1600 kW each.	Gas pressure-jet condensing boilers: two at 720 kW each.	Calorifiers from Whitehall high temperature hot water DH - District Heating system.[4]
Domestic hot water	Separate gas boiler, 156 kW.	Office: local electric immersions.	From main boilers. Separate hot water boiler under consideration.	From central calorifiers served by the DH during the heating season and electric immersion heaters in summer.
Kitchen hot water	From above.	2 no. 20-77 kW gas boilers added in 2008 to supply the original calorifiers.		
Heat emitters	Perimeter radiators	Perimeter trench heating	Ceiling fan-coils.	Perimeter radiators and some finned tube heaters
Ventilation and cooling systems	Mixed mode with natural vent, chilled ceilings and extra variable fresh air from floor outlets.	Displacement ventilation from floor, plus a mix of chilled beams and chilled ceilings.	Ceiling fan-coils with perimeter diffusers and mechanical fresh air.	Natural ventilation. Local mech vent. Fan coil comfort cooling (top floor, some mtg rooms).
Variable volume control	Widely used, on pumps and fans.	Available for main fans and pumps.	Widely used, on pumps and fans.	Mostly constant volume.
Chillers	R134a, 2 x 864kW, output reciprocating chillers, with air-cooled condensers.	R134a, 2 x 1200 kW output, single screw chillers, with air-cooled condensers.	Ammonia, screw, variable speed, 2 x 450 kW output with evaporative condensers.	3 main chillers with cooling towers. The system is 30 years old and will be replaced this year.
Server and hub rooms and cooling	Total load to be confirmed.	Main room with local system. Total machine load (UPS) about 80 kW.	8 rooms on main chilled water system. Total load less than 20 kW.	Main room with local system, plus additional dispersed rooms. Total machine load about 100 kW.
Humidification	Electrode boilers	Electrode boilers, but very rarely used	Not fitted	Not fitted
Heat recovery	Heat recovery from chillers to heat store, used to preheat air.	Run-around coils under consideration.	Run-around coils fitted on main office plant only.	None. Many small independent ventilation plants.
Electronic BMS	Satchwell. Changing to Trend.	Satchwell	Siemens	American Auto-Matrix and Trend.
Lighting management system	Apex, with PIRs occupancy sensors to grouped luminaires.	No. Self-contained "intelligent" luminaires only in both old and new systems.	Apex, with PIRs to groups of typically 9 luminaires in offices. PIRs also in toilets and most corridors.	Some PIRs
Typical lighting loads in offices	13 W/m^2	Old system 18 W/m^2 New system 8 W/m^2	10 W/m^2	Variable, with low light intensities in many areas and new systems using efficient T5 sources

[4] The district heating system supplies high temperature hot water to Whitehall buildings during the heating season from central plant located near the Embankment, including gas turbine CHP. The FCO's gas consumption is relatively small (6% of the district heating total), with gas used only for catering and for the domestic scale boilers serving the Crisis Management team's accommodation.

	BIS 1 Victoria Street	**CLG** Eland House	**DECC** 3 Whitehall Place	**FCO** King Charles Street
Power conditioning	Under consideration.	Independent research is being commissioned.	Voltage optimisation installed in March 2009. Its effect is as yet unclear.	Power optimisation is being considered.
Electricity sub-metering	Eight half-hourly meters recently installed.	System recently installed but not yet fully commissioned.	Original system up-graded but not yet fully commissioned.	A system is under consideration for all FCO buildings.

3.0 OVERVIEW OF ENERGY USE AND MANAGEMENT

3.1 Introduction

Reducing energy use in office buildings requires a balance between:

- Facilities Management, striving to improve the efficiency of systems, plant, equipment and its own management capabilities;
- Business management, wishing to make more intensive use of buildings by increasing occupancy levels and hours of use; and
- A tendency to use more powerful equipment, particularly but not solely ICT. While equipment is becoming more efficient, the trend in overall energy use is often overwhelmed by increases in numbers, sizes and capacity, and desire for things to be electronic and "always on". The 8,760 hours that make up an entire year is a long time to be using electricity, even for equipment with small consumption levels or left in "sleep" mode[5].

Despite this underlying growth, the managers of all four buildings have been able to reduce energy use significantly, with added impetus when DECs were introduced. This is reflected in the DEC grade improvements between 2008 and 2009 in the three newer buildings as shown in Table 2. While FCO's published DEC in 2009 moved from D to E, the difference has been traced to the omission of one of FCO's eight electricity supplies from the 2008 total. Taking this into account, FCO also made electricity savings. The small increase in FCO's heating energy use over the period can be more than accounted for by 2008-09 being a colder winter.

The main measures adopted so far have been to improve control and avoid waste. Some capital measures have also been undertaken and others are planned, as outlined below. While future pressure to improve energy efficiency and cut carbon emissions will be relentless, at some stage the law of diminishing returns will set in. Hence the need for the innovative techniques and technologies that can initiate step-changes, and which are the subject of this competition.

3.2 BIS - Energy use and savings measures

EC Harris manages the FM contract at 1 Victoria Street while Cofely provides the support services. This arrangement has allowed the FM team to take a strategic view of the building's energy efficiency, starting with tighter management, more effective use of the existing lighting management and BMS systems[6], switch-off campaigns for PCs and printers, and relatively low-cost alterations, e.g. lamp replacements. Electricity use in 2009 totalled 6,288,000 kWh, a 13 % reduction on 2008. Gas use in 2009 was 2,097,000 kWh, of which 47,000 kWh was for the kitchen: directly comparable 2008 figures are not available. The building also has a 30 sq m photovoltaic array on the roof, but its annual contribution of about 3,500 kWh is small.

Proposed energy reduction measures either in progress or at business case stage include:

- **Central control** - Replace BMS and upgrade the lighting management system.
- **Local control** - PIR shields to stop security rounds activating unnecessary lights.
- **General lighting** - Ongoing replacement of T8 with T5 lamps.
- **Other lighting** - Pilot replacement of tungsten halogen lamps with LEDs.
- **Accent lighting** - Plans to upgrade CFL "shoe box" recessed wall-washers, which are widespread, with some decommissioning. Review of cold cathode pelmet and perimeter lighting in conference area.
- **ICT support** - Printers etc. are already clustered into dedicated areas, for which dedicated time switches are under consideration.

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[5] For example, a modern Ethernet-connected telephone handset can use 5 Watts all the time, which amounts to 44 kWh of electricity each per year, accounting for about 25 tonnes of CO_2 per year for an office with 1000 workstations, before any of the switching equipment is included.

[6] Especially time, volume and temperature control of the mixed-mode ventilation and cooling system and the associated variable-volume fans, pumps and dampers.

3.3 **CLG - Energy use and savings measures**

CLG's FM contract with MITIE at Eland House is more conventional. With no consultant permanently retained, the impetus for improvement has come from CLG itself, seeking advice as necessary. The combined result has been very similar to that at BIS, and with tighter operating hours and a major tune-up of control strategies and settings, and has led to significant energy savings. In the year to April 2009, electricity consumption totalled 5,033,000 kWh (6% down on 2008) and gas 2,343,000 kWh (15% down). Measures undertaken included reviewing air volumes and hours of operation, very rare use of the electric humidifiers, improving boiler sequence control, a separate gas-fired hot water boiler for the kitchens, and an ICT switch-off campaign. An electricity sub-metering system has been installed, but is not yet fully commissioned.

Energy-saving measures planned, in-progress, or being considered include:

- **Central control -** A BMS upgrade is under consideration.
- **HVAC systems -** Run-around heat recovery is under consideration. With the recent rise in occupancy levels, the speeds of the main fans have had to be increased, so automatic control in relation to air quality is now being considered.
- **General lighting -** New units will replace the self-contained "intelligent luminaires" over the next few months. This will reduce installed power density from about 18 W/m^2 to about 8 W/m^2. There will also be control savings from improved sensors.
- **Other lighting -** Ongoing replacement of T8 with T5 lamps.
- **Desktop equipment -** Further replacement of desktop PCs with laptops.
- **ICT support -** Clustering printers etc. into dedicated areas, making more use of multi-functional devices, and adding time controls for nights and weekends.
- **Catering and vending -** Considering switching off water coolers.
- **Server room -** Upgrading chillers with heat recovery to pre-heat kitchen hot water.
- **Chilled water supplies -** Possible use of groundwater borehole cooling.

3.4 **DECC - Energy use and savings measures**

DECC was formed in October 2008. It sub-let 3 Whitehall Place from DEFRA and made internal alterations before increasing occupancy levels significantly from about 500 workstations to over 800. DEFRA's former FM contract ended in March 2009. New tenders were sought for a 15-year Sustainable Workplace Management contract, and won by Interserve. This new contract provides more scope for FM to be proactive in operating the building and for suggesting improvement measures. DECC also appointed Briar Associates as energy and carbon consultants, with additional support from the Carbon Trust. This means DECC, Briar and Interserve can work together to identify and then undertake technical and operational improvements.

The changeover and building work undertaken during occupation somewhat increased gas and electricity consumption in the first half of 2009, when a lot of evening and weekend working took place. In the second half of the year, improvements in control and management compensated for this, and the DEC Grade (previously G) fell just into the F band. Consumption in the 12-month period to October 2009 was 1,972,000 kWh of electricity (5% down) and 1,326,000 kWh of gas. Energy performance over the next year is expected to be much better than this, owing to improvements already made. FM data for the second half of 2009 indicates that electricity consumption over the year to October 2010 could be at least 15% less than the year before, and quite possibly 20%. The new regime has already achieved major reductions in heating requirements from improved control and management. Summer and autumn consumption has been 10-15% of that the year before, and even in the recent cold weather gas consumption has more than halved. For the whole year, a drop in annual gas consumption of at least 60% is anticipated, and possibly as much as 65%.

When renovated, the building had a comprehensive sub-metering system that recently has been consolidated and extended. However, it remains to be fully commissioned and the user interface could be improved. While sub-metering systems are now becoming more common, e.g. to meet the requirements of Building Regulations Part L, there seems to be scope for innovation to improve their usability in practice and to make good

information simply and transparently available to management.

Savings measures already implemented at 3 Whitehall Place include:

- **BMS -** Much tighter BMS control and operation of the HVAC plant, particularly the boilers. Making more effective use of the existing variable air and water volume controls, and the dampers and hot and chilled water isolation valves for each floor.
- **Lighting -** Re-tuning the lighting management system. Avoiding excessive PIR switching on security rounds. Changing some tungsten halogen lamps to LEDs.
- **ICT -** Changing from PC workstations (measured at 92 Watts) to laptops (approx. 25 Watts) plus docking stations to external LED screens (approx. 35 Watts each, giving 60 Watts total); together with a switch-off campaign, augmented by security routines.
- **Kitchens** - Replacing a tunnel toaster (which operated constantly during serving hours) with pop-up toasters, used on demand. Switching off the chilled display cabinet in the servery at the weekend, transferring the contents into the cold room.
- **Server rooms -** The pairs of air-conditioning units in the three main rooms are now controlled in sequence from room temperature, with the second units coming on only when the room temperatures rise beyond high limit settings. The same approach is applied to the substation/main intake room, which lacks natural ventilation and sometimes needs mechanical cooling.
- **Electric power optimisation –** A voltage optimiser had been ordered under the former DEFRA regime and was installed in early 2009, around the time that the FM contract changed and the refit work was at its height. Owing to all this activity, it has been difficult to isolate the effect of the optimiser itself. More research is now required.

Further energy-saving measures under consideration or in progress include:

- **Air conditioning -** Adapting controls in meeting rooms so PIRs, which currently activate the lighting, can also operate the air-conditioning fan-coils.
- **Lighting** - Replacing halogen lamps in lifts, corridors and over basins with LEDs. Re-organising switch circuits to separate lights in the servery and the dining area.
- **ICT support** - Printers etc are already grouped in dedicated areas, typically in three locations per floor. Time switch control has been piloted successfully, using plug timers and providing good user instructions: this will be extended.
- **Catering and vending** - The building has 25 pairs of hot and chilled water taps for drinks, which are proving expensive to maintain. Alternatives are being considered.
- **Server and hub rooms** - Eight small machine rooms (with a total load of not more than 20 kW) are currently on the building's central chilled water system, causing it to operate 24/7. While the main chillers and pumps are variable speed, high losses nevertheless occur. A separate chiller and distribution system is being considered.
- **Better user awareness –** Display metering and motivational programmes are under consideration.

When the building was sold to a private developer, it was disconnected from the Whitehall district heating system. Reconnection is now being considered. However, energy supply measures such as this are outside the scope of this competition.

3.5 **FCO - Energy use and savings measures**

FM services at King Charles Street are provided by Interserve, on a 7-year contract that started at the end of 2008. Making savings may be more difficult here owing to the building's inherent poor thermal performance, Grade 1 listing and a collection of ad hoc building services that need individual attention. Some changes to control settings are now being made. Lamps are also being upgraded, often to T5 fluorescent, including PIR occupancy sensors where appropriate. Half the lights in the corridors have been manually isolated and the security switch-off regime is strict. In the year to April 2009, 7,366,000 kWh of electricity was used (6% down) and 4,859,000 kWh of high temperature hot water from the Whitehall district heating (DH) mains (a 3% increase, but in a colder winter). When the DH mains are off in summer, electric immersion heaters in the central calorifiers are used to provide domestic hot water.

Of the 303,000 kWh of gas consumed, about 40% of this is for the catering kitchen and

the rest is for heating a small part of the premises which is not on the main system. Gas consumption in 2008-09 was 23% greater than the previous year, but in absolute numbers it is small, accounting for just 1% of the annual district heating total.

Future planned energy savings at FCO include:

- **Control** - Lowering heating set points to a maximum of 21°C.
- **Heating** - Replacing existing district heating calorifiers with plate heat exchangers.
- **Cooling** - Replacing existing main chillers and cooling towers, 30 years old.
- **Chilled water** - Exploring the feasibility of integrating all circuits and separating 24-hour loads.
- **Lighting** - Continuing replacement of T8 fluorescent lighting with T5 tubes. Also replacing tungsten halogen accent lighting with LEDs.
- **PCs -** Implementing Vista power-saving settings.
- **Catering** - Replacing old refrigerators with energy-efficient models and replacing boiling water taps for drinks.
- **Electricity supply** – Investigations of power optimisation are at an advanced stage.
- **Metering** - An automated system is under investigation for use across the FCO estate.

4.0 ENERGY USE COMPARED AND CONTRASTED

4.1 Introduction

Preliminary energy surveys of the four buildings have been undertaken, to appreciate more about how the patterns of energy use and CO_2 emissions compare with industry benchmarks. The surveys used CIBSE TM22 - a method of successive approximation, which can produce a rapid initial estimate of the breakdown of energy use and associated carbon dioxide emissions, and can be refined progressively as more information becomes available. Given the limited time, the scale of the buildings, the rapidly changing use of energy, and issues with sub-metering, it is only possible to give a general picture using initial approximate breakdowns. Further information may become available at a later phase of the competition.

Figure 1 summarises the energy performance of the four buildings[7], expressed in terms of annual carbon dioxide emissions[8] per square metre of Net Internal Area[9]. This will help to identify the priorities in relation to government policy to reduce carbon emissions. The buildings are compared with each other and with Typical and Good Practice benchmarks[10] from Energy Consumption Guide 19 ("ECON 19) for "Type 4" prestige air-conditioned offices[11]. The benchmark for a Typical naturally ventilated "Type 2" open-plan office is also shown. For ease of comparison, the CO_2 emissions from the heating at FCO are shown as if the heat had been supplied by gas boiler plant operating at 80% mean seasonal efficiency.

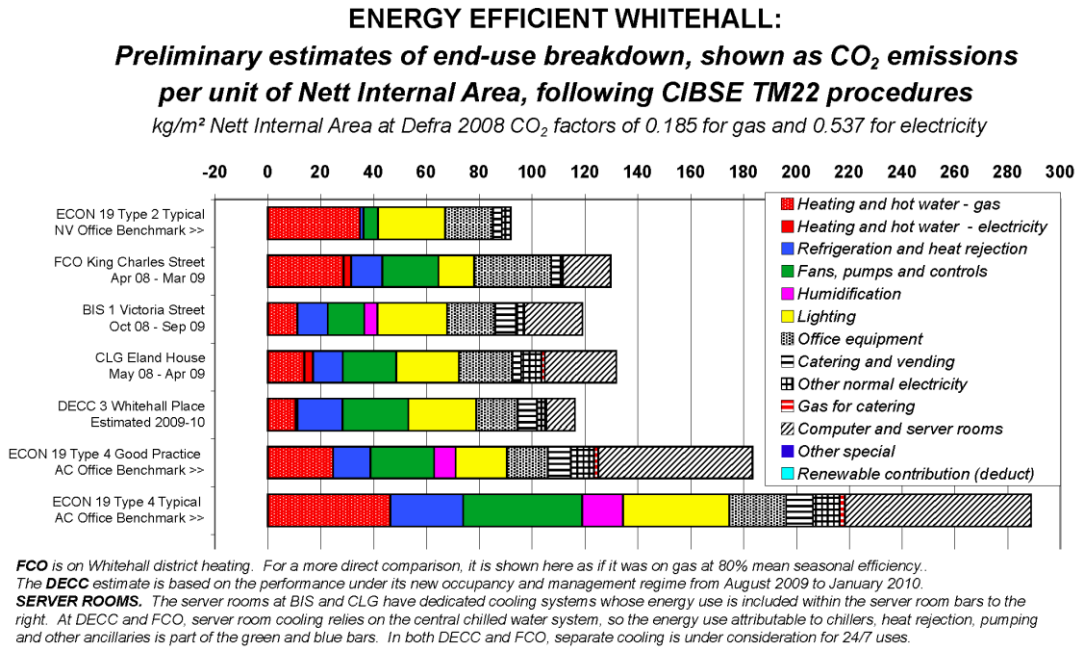
The coloured parts of the histogram bars represent the CO_2 impact of the energy used by normal building services: heating and hot water in red (if electric in a deeper red); cooling and heat rejection in blue; humidification in purple; and lighting in yellow. The black-and-white parts are mostly equipment introduced by occupiers, especially office machines, catering equipment and server rooms. The "other normal" includes items like lifts, sewage pumping, security systems, fire alarm and emergency lighting systems.

The data for BIS, CLG and FCO are based on historic energy use in 2008-09 but this approach proved inappropriate to describe the situation at 3 Whitehall Place, where so much has changed in the past year. Building work, a new occupier department, new ICT, a much higher occupancy density, energy consultancy, a new "sustainable workplace management" FM contract, substantial fine-tuning of the BMS and lighting controls, and a number of capital investments explain this change. The data for DECC is therefore a conservative[12] annual estimate for the year to August 2010, based on the energy use at 3 Whitehall Place between September 2009 and the end of January 2010.

The bars to the far right of Figure 1 show energy use in server rooms and associated communications, data and hub rooms. They include all equipment in the server room, including room air-conditioning units. If the rooms have self-contained dedicated air-conditioning systems, they also include the associated compressors and condensers. However, the systems at DECC and FCO are cooled by the central chilled water systems also used for space cooling, and so also lead to energy use within the blue and yellow bars.

[7] Since all the buildings are within central London and the data is for similar periods, degree-day weather corrections have not been applied to the heating data shown.
[8] The CO2 factors applied to both the buildings and the benchmarks are the 2008 Defra/ Carbon Trust values of 0.185 kgCO2/kWh for gas and 0.537 kgCO2/kWh for electricity. These are slightly different from the factors used in DECs.
[9] Net internal area (NIA) was chosen because it represents the "business area" of a building, and has already been chosen by OGC for its e-PIMS database, from which the areas were taken. For three of the four buildings, the team had found differences between area data that had been collected from different sources.
[10] The benchmarks in ECON 19 are expressed in Treated Floor Area (TFA). The Guide gives a rule-of-thumb conversion factor of 80% for converting TFA to net internal area. Accordingly, Type 4 benchmark values in ECON 19 are multiplied by 1.25. This is also the factor given in CLG's guide to DECs, for converting NIA into Total Usable Floor Area.
[11] Putting aside the issue of classification, Type 4 was chosen because it provides a common basis, is not an unreasonable reference for Whitehall Ministries, and includes references for catering kitchens and computer rooms, which can aid discussion.
[12] Current information suggests that annual electricity use in the year to August 2010 could be 20% less than the year before, with gas 35% of the previous level, in spite of the cold 2009-10 winter to date. The estimate shown in Figure 1 is based on 15% less electricity and 60% less gas.

Figure 1: Annual Energy Performance Compared



FCO is on Whitehall district heating. For a more direct comparison, it is shown here as if it was on gas at 80% mean seasonal efficiency..
The DECC estimate is based on the performance under its new occupancy and management regime from August 2009 to January 2010.
***SERVER ROOMS.** The server rooms at BIS and CLG have dedicated cooling systems whose energy use is included within the server room bars to the right. At DECC and FCO, server room cooling relies on the central chilled water system, so the energy use attributable to chillers, heat rejection, pumping and other ancillaries is part of the green and blue bars. In both DECC and FCO, separate cooling is under consideration for 24/7 uses.*

4.2 Overview of end-use breakdowns

Figure 1 shows that the performance of all four buildings (as expressed in kg CO_2/m^2 NIA) lies in a tight bunch between the Typical Type 2 naturally-ventilated and the Good Practice (GP) Type 4 air-conditioned head office benchmark.

Working from left to right:

- FCO has the highest heating energy use[13] of all four buildings, but no higher than a typical naturally ventilated office benchmark. DECC's 2008-09 value was just above the Type 4 GP benchmark, but here we show a high estimate of the likely outcome in 2009-10, which is 60% less than the previous year. This illustrates how much can often be achieved by minimising waste in mechanically ventilated and cooled buildings, following improving control and management of existing installations. BIS and CLG have already made savings of a similar magnitude over recent years, to reach similar levels of performance, much better than the established GP benchmark.
- Apart from DECC, cooling energy use is similar in all the offices, and slightly better than the GP benchmark. The estimate at DECC is higher, owing to the characteristics of fan-coil air-conditioning, and because the server and hub rooms require 24/7 operation of the main chiller plant and pumps. These machine rooms are also on the central chilled water system at FCO.
- Energy use by pumps and fans is modest at BIS and CLG, owing to their use of chilled beams and ceilings. For a given amount of cooling, water requires considerably less energy to circulate than air. DECC uses the most, owing to its fan-coil systems and the substantial amount of mechanical ventilation in the basement and lower ground floors.
- It may be surprising that FCO, with its tall ceilings and which is predominantly naturally ventilated, has a very similar performance for cooling, fans and pumps to a GP air-conditioned building. The reasons include the 24/7 server room and other loads, about 25% of the floor area now being mechanically ventilated and/or comfort cooled, and relatively old systems. The chillers are being replaced this year.
- Lighting energy use at the FCO is relatively low. This is partly because installed power levels are low, owing to modest luminance levels in places and to high efficiency where lights have been replaced; and partly because the cellular nature of the building means

[13] Note that this is based on the gas-fired equivalent. It is understood that the CO_2 factor on the Whitehall district heating system (which incorporates a CHP unit) is lower than this.

that lights in individual rooms are more likely to be switched off. Lighting energy use in the other three buildings is similar. CLG's higher installed power density (currently about to be halved) is counterbalanced by its individual occupancy sensors and dimmers, which allow the use of lighting to be more responsive to local demand.

- Energy use by office equipment is high at FCO, owing to an ICT policy that requires machines to be left on overnight, though more efficient sleep modes are now being implemented. The other three buildings have strict switch-off policies. Although DECC has the highest workstation density, the initial estimate of office equipment energy use here is smaller than the others. Reasons include the use of laptops with docking stations on each desk, connected to energy-efficient external screens with LED backlighting. DECC has also restricted the number of printers and copiers and has a particularly strict switch-off policy, including instructions to night security rounds to check equipment left on and to switch it off unless instructed.
- Server room energy use is modest in relation to the Type 4 benchmarks, which are indicative only. The Type 4 benchmarks were determined when large computer suites tended to be found in head offices but now these facilities have tended to be relocated to dedicated data centres. The relatively low apparent server room impact at DECC and FCO is also the result of the associated cooling, chilled water pumping and heat rejection energy and here is included in the blue and green bars, as discussed earlier.

4.3 Electricity demand profiles

Half-hourly electricity demand profiles reveal close similarities in W/m^2 performance:

- **BIS** - 11 W/m^2 NIA at nights and weekends, 40 on a winter day[14].
- **CLG** - 13.5 W/m^2 nights and weekends, 43 on a winter day, 56 on a summer day.
- **DECC** – Historic data shows 13.5 W/m^2 nights and weekends, 40 on a winter day, 63 on a summer day, but this is now falling.
- **FCO** - 15 W/m^2 nights and weekends, 29 on a winter day, 30 on a summer day.

The night loads are higher at FCO, owing to the central cooling system operating 24/7 and some mechanical ventilation systems also operating overnight. However, additional use in summer is small, presumably with the extra cooling and hot water loads being balanced by less lighting. The other buildings show higher daytime loads than FCO, particularly in summer when the chillers operate. The base load electricity demand of all the buildings means that about half their annual electricity occurs at night and weekends, when they are largely empty. While not unusual for office buildings, it is now a vitally important area to tackle.

[14] Good information for a summer day was not available at the time of writing, but is likely to be just under 50 W/m^2.

5.0 ENERGY-RELATED THEMES

5.1 Introduction

Energy and carbon savings can be approached through a hierarchy of measures:

- **Engage people** - If people aren't inspired, no amount of technology will do it for them. Energy and carbon performance must be made visible and inspire action. For government buildings in operation, Display Energy Certificates have been a useful first step and have begun to motivate managers and to engage stakeholders.
- **Reduce demand** - For example changing habits, questioning standards, using passive measures such as insulation, shading, natural light and ventilation, and deciding whether certain things are really necessary e.g. drinking water coolers.
- **Increase efficiency** – Having reduced demand, going on to improve the efficiency of building services plant (boilers, chillers, ventilation systems, lights and so on) and also ICT systems and electrical appliances. This is a rich area for new technology in terms of more efficient approaches and products. There are also opportunities for system integration and energy recovery.
- **Improve controls and monitoring** - There is much scope for improving the functionality of control systems at all levels, from BMSs and sub-metering systems to individual room controls. This includes their management and user interfaces[15]. Good control, combined with effective feedback on achieved performance, will help to match supply to demand in a responsive and efficient way, and is a rich area for new techniques and technologies.
- **Avoid waste** - Much can be done by changing attitudes and habits, so that individuals and management do not use more energy than is needed, e.g. by switching things off whenever possible. This will be assisted by better controls and monitoring, as outlined above. Better controls will respond to demand whilst also ensuring efficient operation, include better monitoring of outcomes, and be brought together by techniques that help people do the right thing. There is a major issue for UK offices in preventing equipment defaulting to ON when not needed.
- **Decarbonise energy supplies** on and off-site. Lower-carbon energy supplies and on-site renewables are out of scope for this competition. Rather, the focus here is on reducing a building's demand for energy. The energy hierarchy illustrates that once demand is reduced any low-carbon energy will go further in servicing office space that also needs to remain functional, attractive, efficient and productive.

By applying the thinking above to the insights obtained from reviewing energy use in the four buildings, we have identified ten crosscutting Themes associated with energy use and management. The Themes are intended to help identify areas for innovations and are outlined below.

Integrated approaches are strongly encouraged that bring together several Themes, and/or several different techniques and technologies within a Theme. Since innovation is being sought, applicants are also welcome to suggest other themes and solutions too. Accordingly, the **Theme X** category is designed to allow for this.

Overall, the innovations should aim to be low in environmental impact in production and installation, and not just in use. So the use of low-impact and renewable materials and processes must always be taken into account.

15 Not just at the building management level, but also for areas within it, and increasingly for higher-level management information across a number of buildings. This portfolio information may also need collecting by a range of different stakeholders, e.g. the landlord, the occupier's organisation, the facilities management organisation and the refrigeration engineer – each of whom will want to compare the performance of "their" buildings across different portfolios.

5.2 The ten energy-related Themes

Theme 1 – **Out-of-hours electricity.** In all four buildings, metered half-hourly data has revealed major base-loads of electricity use of between 10 and 15 W/m^2 NIA. While those used to analysing electricity demand profiles of air-conditioned commercial offices may regard these as modest, they account for CO_2 emissions in the region of 50 kg/m^2 per year, and will be difficult to justify in the future low-carbon economy.

Theme 2 - **Behaviour change.** This relates to the first step in the hierarchy - to "engage people". Innovations are required that make people more aware of the energy and carbon implications of their actions, and that influence the decisions they make. These decisions may range from strategic ones about the energy and carbon implications of policy and purchasing, to tactical ones about day-to-day behaviour. This is an important area for linking-up "soft" and "hard" issues through the way people do things; how they interact with a building and exercise control; and how they can appreciate the effect they have on its performance, with positive reinforcement through receiving feedback.

Theme 3 - **Enhanced building and facilities management.** This is a key aspect of behaviour change. The rapid savings that are already being achieved in the four host buildings demonstrates that this is fertile territory for improvement. What can be learned from what is happening here (and elsewhere) about how to replicate this experience in other buildings? How much further can it be taken? Can new supporting techniques and technologies be developed to allow improved service performance within existing service contracts? There could be an innovative role for information technology here.

Theme 4 - **Feedback and display** of energy use. This is closely linked to Themes 1, 2 and 3 by helping people improve the management and use of energy in both central building services and the local use of IT equipment. There has been much recent interest in "smart" control and metering and energy display technology. How smart will the metering and display hardware actually prove to be if human-machine interactions are not properly considered in the control loop? Though it is still early days, the difficulties encountered in the host buildings in bringing their sub-metering schemes up to good levels of functionality and usability suggests that there is a long way to go.

Theme 5 - **Building fabric.** Major alteration to fabric is outside the scope of this competition, owing to the variety of contexts and the need for lengthy approvals e.g. building regulations, landlord permission and listed building consent at FCO and DECC. Nevertheless, there may be scope for simple, reversible innovations, e.g. additions to existing single glazing systems that provide radically improved performance, e.g. to heat loss, solar gain or daylight distribution. At present the buildings make less use of daylight than they could, while localised solar gains and glare are issues at CLG, DECC and FCO.

Theme 6 – **Lighting**. Site visits have identified the following issues in improving energy performance in either or both the tenant and landlord areas:

- General lighting - All three newer buildings have lights in the suspended ceilings with occupancy sensing and CLG and DECC also have perimeter dimming controls. The most efficient of these (DECC) achieves 350 lux at about 10 W/m^2 of installed power. One question is whether innovative approaches can deliver good quality lighting at say 5 W/m^2, or even less.
- Other lighting - Tungsten halogen to LED conversion is taking hold across the host buildings. However, compact fluorescent sources are more widely used, especially in circular down-lighters in corridors, WCs, meeting rooms etc. Areas are frequently over lit, but owing to ballast characteristics it is impossible to undertake a simple lamp change. Simple, low cost solutions to this problem would be welcome.
- Escape stairs and other circulation areas – These are often lit 24/7 owing to concerns about safety. Are there replicable, cost-effective, fail-safe retrofits that avoid this?

- Other controls issues are dealt with as Themes 9 and 10.

Theme 7 - **HVAC.** It is difficult to generalise, owing to the differing details of plant and equipment. Accelerating the replication of more effective control and management, and finding ways of making much better use of existing BMS and controls systems (see Theme 9) and FM arrangements would help here. These Whitehall buildings are already beginning to illustrate the substantial savings that can be made once there is motivation and capabilities to improve performance.

Theme 8 - ICT and appliances. Use of energy by ICT systems is a major problem for building and facilities management within offices where there is often little FM and user influence on purchasing and management decisions. Directly and indirectly, "always on" ICT accounts for an ever-larger component of out-of-hours loads (Theme 1), even though much of the ICT is not being used. This is a problem for the ICT industry to tackle and such innovations are outside the scope of this competition, except where they are directly building-related.[16] However, ways of minimising and managing ICT energy use in buildings offers considerable scope, both at the desktop and in the communications infrastructure. Energy use by other appliances is also under scrutiny across the four buildings, with catering, vending and drinks dispensing operations all coming under question.

Theme 9 - Better central and local controls. Issues with functionality and usability of central and local controls cause widespread problems in many buildings, for occupant satisfaction as well as energy use.

- At the centralized level involving controls for management, there is a need for intelligent diagnostics to help identify where there may be problems and to offer ideas for improvement. User interfaces could also be much more intuitive, for example to provide rapid access to detailed information and make comparisons; and to allow non-technical FM staff to grasp what is happening easily in order to make simple interventions within their level of authority, e.g. to adjust settings or run times to meet changing circumstances.
- At the local level much energy wastage occurs. The user control devices specified and/or the ergonomics of the user interfaces actually provided are often not well suited to the task in hand. Often it is difficult to make alterations to respond quickly to changing user requirements, or to restore safe and energy-efficient default states when people go away (e.g. manual on, manual and auto off). Good functionality and usability is often missing even in common situations, e.g. meeting rooms.

Theme X - To open up the competition to the widest possible scope for innovation Theme X is included. It is important to note that all proposals must be demonstrable in one or more of the host buildings, but also needs to show potential for replication within other government, public and commercial offices.

5.3 **Buildings versus themes**

The matrix of themes versus buildings is shown in Table 3, and is deliberately left empty. Applicants should use the table to help identify how their proposals address the particular themes, and the extent to which their innovations are likely to apply to the four host buildings. Clearly there are many permutations available for submitting initial applications: for example, from concentrating on a single theme in a single building, to addressing several themes across all buildings.

[16] This competition is in step with the current 'Greening of Government ICT ' programme but specifically focuses on innovative building-related measures to reduce energy and carbon rather than the much wider issue of the sustainable manufacture, distribution, use (inside and outside buildings) and disposal of Government ICT.

Table 3: Buildings versus themes

		BIS 1 Victoria Street	CLG Eland House	DECC 3 Whitehall Place	FCO King Charles Street
1	**Out of hours electricity**				
2	**Behaviour change**				
3	**Enhanced building and facilities management**				
4	**Feedback and display**				
5	**Building fabric**				
6	**Lighting**				
7	**HVAC**				
8	**ICT and appliances**				
9	**Central and local control**				
10	**Theme X**				

6.0 CONSTRAINTS

As with the energy themes, the context and constraints of this competition are many and varied and will require careful consideration by all applicants when submitting proposals. Key constraints we have been able to identify at this point are offered for general awareness and guidance.

6.1 **Confidentiality** – Applicants will only use this Strategic Brief and the associated application forms and guidance as the basis for submitting their initial proposals. They must not attempt to obtain additional information by making direct contact with Government employees or outside contractors already associated with the host buildings.

6.2 **Access** – No access to the host buildings will be possible during the initial application stage. Security clearance may be required for anyone visiting or working on the buildings at subsequent stages of the competition.

6.3 **Statutory** – We do not expect submitted proposals to include measures that require statutory planning approval in order to be implemented. However, proposals requiring building regulations, local fire officer or normal landlord approvals will be considered. Listed building constraints also apply to FCO and DECC.

6.4 **Ongoing contracts** – Incumbent government departments have ongoing service contracts with facilities and building management companies and consultants. These companies will be allowed to submit applications for this competition.

6.5 **Landlord-tenant** – Proposals could impact on current landlord and tenant arrangements and this may influence their suitability.

6.6 **Work in progress** – Each building has ongoing 'work-in-progress' to address some of the energy issues identified as well as normal day-to-day monitoring, maintenance and end-user moves.

6.7 **Business as usual** – Every effort must be made during the implementation stage of the competition to avoid disruption to normal departmental business.

6.8 **User consultation** – Agreed forms of user consultation may need to take place as proposals are developed, following this initial stage.

6.9 **Working closely with occupiers –** Successful applicants will be expected to work very closely with the departments involved in order to supply, fit and demonstrate the operating performance of their solutions. Some training and knowledge transfer to building management personnel and office end-users may well be required.

6.10 **Monitoring –** After installation, all proposals must be capable of being monitored for their effect on building performance, including energy performance and occupant satisfaction. Applicants will need to explain how they propose such monitoring to be undertaken.

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