

# **DECC Energy & Emissions Reduction: Case Studies**

July 2012

# Introduction

Since the creation of DECC on 3 October 2008, we have been engaged in an ambitious and wide-reaching programme to reduce our energy consumption and improve our overall sustainability. We are often asked about projects we have undertaken, and about our past sustainability performance. This document is intended to set out the savings we have made, and the approach we took to achieve them.

## The DECC Estate

### 3 Whitehall Place, London

Our HQ building, DECC took on this building in early 2009. Most of the department's staff are based here, so this building is responsible for the majority of our energy consumption and emissions.

The building dates back to the 1950s, but was completely refurbished in 2004/5 (before DECC's creation), with only the facade remaining, so the building is mostly quite modern. It does still have its challenges though – the windows are listed and so could not be replaced with double glazing (instead we have secondary glazing inside).

Both 3 Whitehall Place and 55 Whitehall are in a conservation area, which poses problems for any projects which affect the outside of the buildings.



### 55 Whitehall, London

This building is next door to 3 Whitehall Place. DECC moved in during the second quarter of 2011. The listed status of this building poses challenges for sustainability measures, as there are limits to the changes we can make, but we have still made significant savings.



### Atholl House, Aberdeen

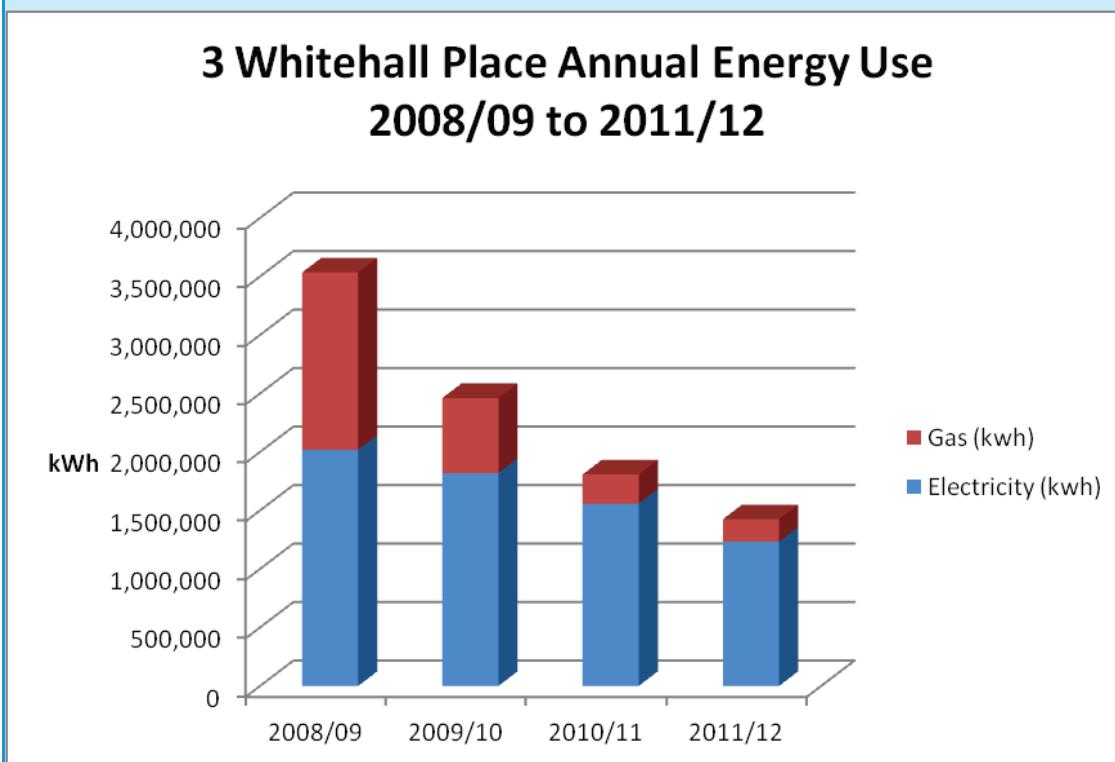
DECC occupy part of this building, but do not manage it. This makes it difficult to achieve or measure savings directly, but we do work with the building managers to make improvements where we can.



# Part 1: Energy & Emissions Savings

DECC has been implementing carbon reduction measures since April 2009 and measures progress on a monthly basis. The department's Carbon Management Plan<sup>1</sup> covers the period 1 April 2010 – 31 March 2015 and sets out the department's plans for energy efficiency and emissions reduction over that period. The main focus of this work has been on our London headquarters, 3 Whitehall Place.

## 3 Whitehall Place

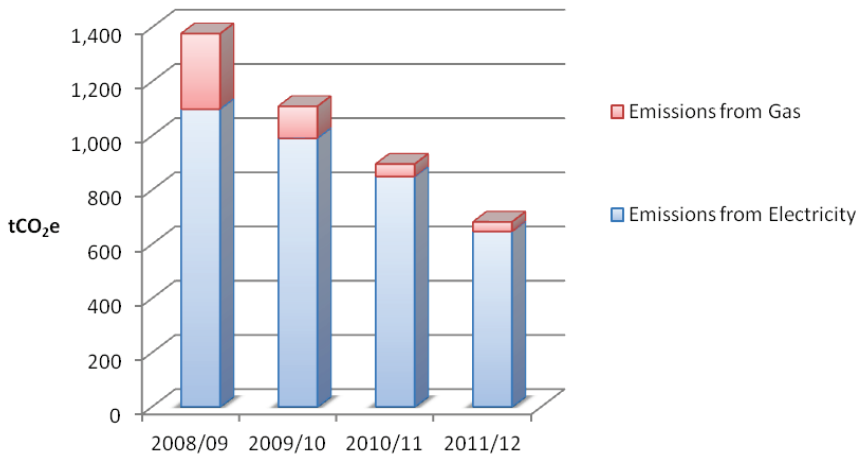


The focus on this building has resulted in a significant and sustained improvement in energy performance and reduction in greenhouse gas emissions. The graph shows the energy consumption in this building over the last four years. We had achieved an 87% reduction in gas consumption and a 39% reduction in electricity consumption in 3 Whitehall Place by April 2012, for a total energy saving of 60%. This is despite a significant increase in the number of staff in the building from 782 FTEs<sup>2</sup> in March 2009 to 1108 FTEs in March 2012 – an increase of 42%. This means that annual office energy use per FTE has been reduced from 4520kWh in 2008/09 to 1287kWh in 2011/12.

<sup>1</sup> Carbon Management Plan: <http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/saving-energy-co2/2130-decc-carbon-management-plan-2011.pdf>

<sup>2</sup> Full Time Equivalent – this is a measure of staff numbers ([http://en.wikipedia.org/wiki/Full-time\\_equivalent](http://en.wikipedia.org/wiki/Full-time_equivalent))

### 3 Whitehall Place Annual GHG Emissions 2008/09 to 2011/12



The result of these savings is that greenhouse gas emissions have been reduced by 50%.

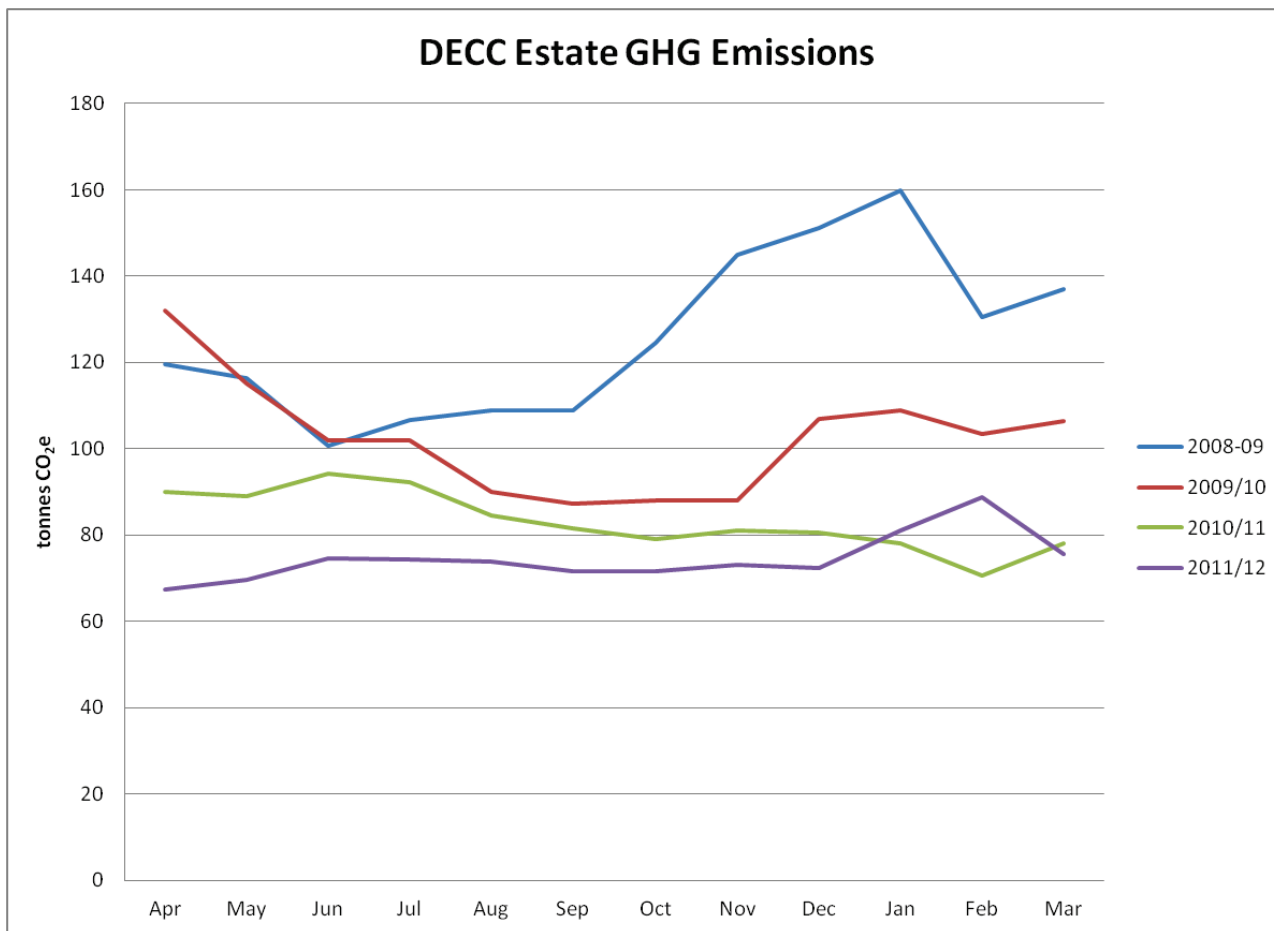
Using the end of year FTE figures, the annual emissions per FTE have been reduced from 1.76 to 0.62 tonnes – a reduction of 64% per person.

## DECC Estate Energy Use & Emissions

Mainly as a result of the savings in 3 Whitehall Place, energy consumption from our whole estate has been reduced by almost half over the past three years and our greenhouse emissions have consequently fallen by more than a third. This is despite taking on a third building (55 Whitehall) in 2011.

One of the ways of measuring energy consumption is through a building's Display Energy Certificate – please see Annex A for information on our progress with improving our buildings' DEC ratings.

The graph below summarises the monthly greenhouse gas (GHG) emissions from the DECC estate over the past four years.



There are a number of things which can be seen from the graph. For the first few months of 2009/10, the energy usage was very similar to the previous year, but as the department's carbon reduction actions started to come into effect, the emissions soon became much lower than the previous year.

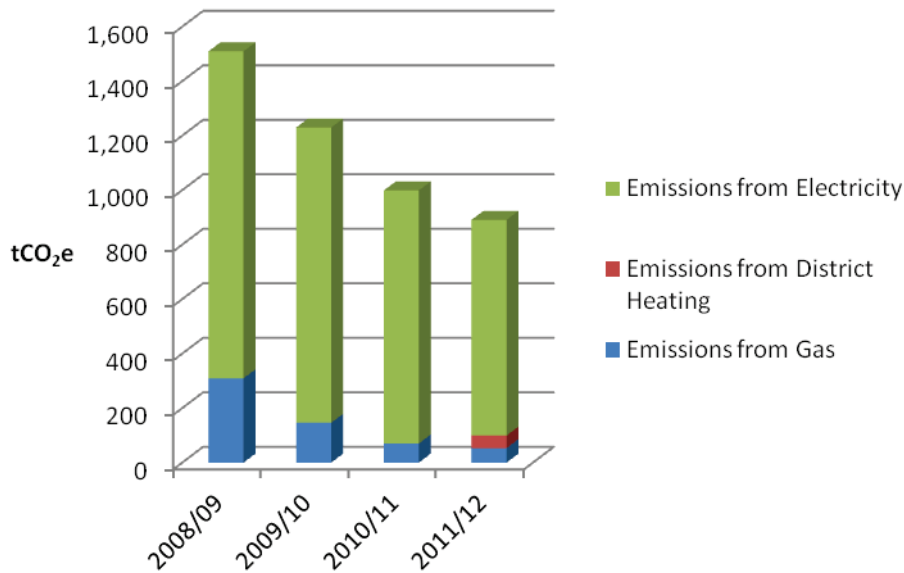
Historically, the period with highest emissions was in winter, as a result of the increased gas use for space heating – the 2008/09 line clearly shows this as a significant “hump”. From 2009/10 we began to reduce this dramatically, and by 2010/11 the winter emissions were generally lower than in the summer months. 3 Whitehall Place is kept warm during winter through heat from sunlight (‘solar gain’) and the heat generated by people and their IT equipment. However, this has a downside - in the summer months, air cooling in 3 Whitehall Place is a significant energy consumer.

In 2011/12 we managed to make significant savings against the previous year, but as the graph shows, the emissions are starting to reach a plateau, and future savings will be harder to achieve.

In 2011/12 our winter emissions have actually increased slightly against the previous year. This is mainly due to space heating in our new building, 55 Whitehall – because of its listed status it is not very well insulated, though it does have high thermal mass, meaning it heats up and cools down slowly.

## Emissions Breakdown

### DECC Estate Annual GHG Emissions 2008/09 to 2011/12

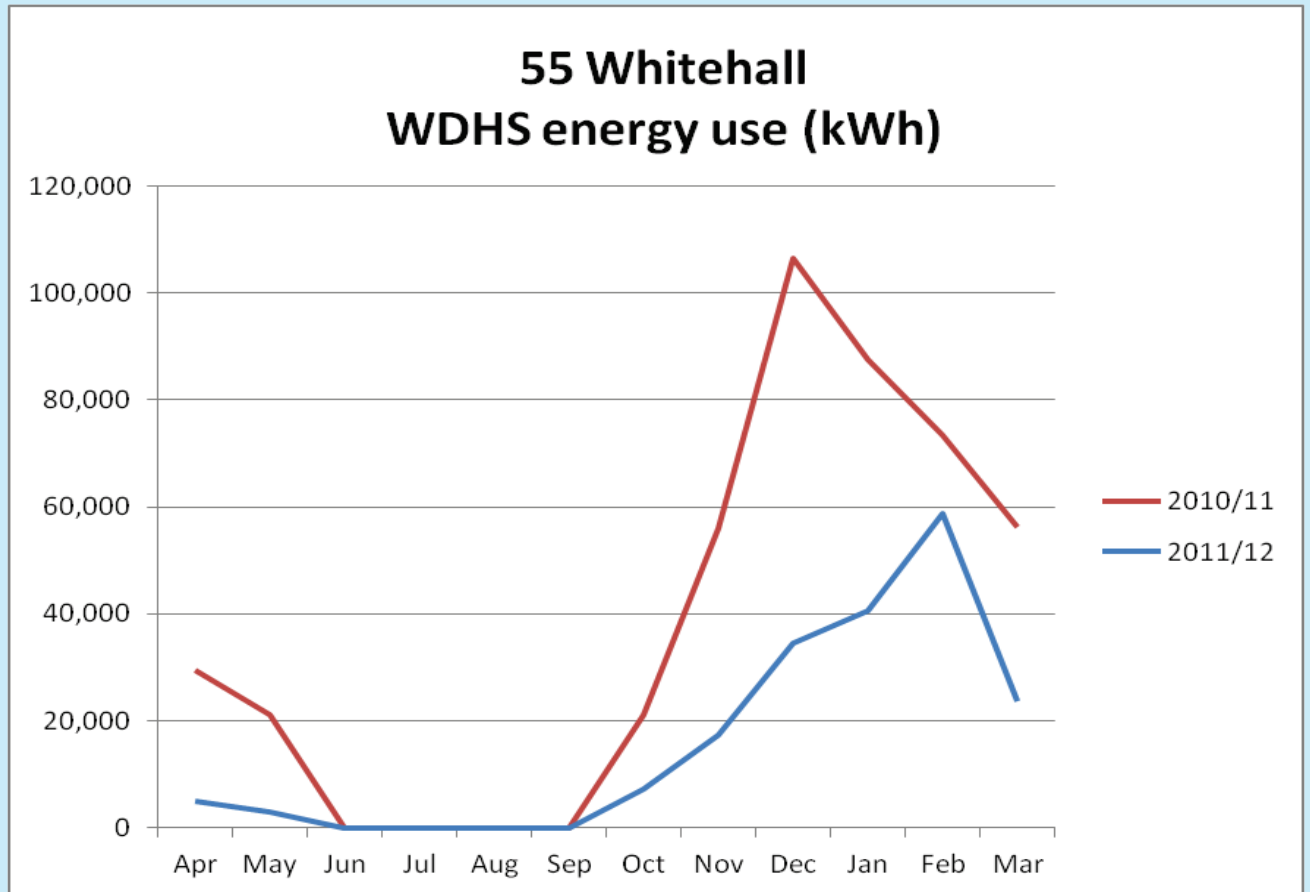


**This Graph shows our estate emissions split by source.**

The Whitehall District Heating System (WDHS) provides heating to 55 Whitehall during the winter (this is why it does not appear in previous years' data before we took the building on).

It is clear from this graph that the majority of our estate's greenhouse gas emissions come from electricity use. This is partly because electricity is responsible for around three times as much GHG emissions per kWh as gas, but also because we have been so successful in reducing our gas consumption which has been cut by 83% in the last three years. Across the estate, DECC have managed to reduce electricity consumption by 32% by the end of 2011/12.

## 55 Whitehall



This graph shows the building's energy consumption through the Whitehall District Heating System in DECC's first year of occupation (blue), compared to the previous year (red). The WDHS is switched off during the summer months, but for the rest of the year we consistently used less energy than the previous year. Energy consumption was down from 451,300kWh to 190,125kWh – a reduction of 58% in our first year managing the building.

## Part 2: How we did it

### Greening DECC

Mainly as a result of the savings in 3 Whitehall Place, energy consumption from our whole estate has been reduced by almost half over the past three years and our greenhouse emissions have consequently fallen by more than a third. This is despite taking on a third building (55 Whitehall) in 2011.

Our first task was to conduct an in-depth audit of our energy consumption to better understand our energy use patterns and demand. By combining this with information on the occupancy patterns of our buildings, we have been able to deliver our building services more effectively and efficiently.

Many of the early changes we made in the building relate to more intelligent use of the building management system – to optimise the controls of our lighting, heating and cooling – and will not be visible to staff or visitors. Yet these no or low cost measures have had – and will continue to have – a significant impact on our carbon emissions, with a short payback period.

Projects during this phase included:

- Modifications and adjustments to the Building Management System controlling the engineering services (such as heating, ventilation and lighting) to make them more efficient
- A major overhaul of the air-conditioning system
- Installation of automatic switches and timers on lighting

**Signs were put up, directing people to the stairs which were not easy to find for anyone unfamiliar with the building. This was aimed at reducing lift usage.**





## Case Study: Building Management System (BMS)

The BMS is the control system for managing the energy consumption of our London estate. Our system monitors and records our energy consumption continuously and in detail. The provision of a large number of electricity sub-meters help us identify high consuming areas or equipment. The BMS system allows rapid modification to equipment, run times and delivery requirements to ensure services are delivered efficiently whilst being responsive to the needs of the department.

Without active management, it is very easy for the system to become inefficient and unresponsive to staff needs. For example, during cold weather adjustments are needed to provide longer hours of heating, but when warmer weather returns, it is important to ensure that the original settings are restored. It is not unheard of for such systems, when badly managed, to heat and cool a building at the same time. A large proportion of our savings have come from modifications to the BMS, and some of the key projects are set out here:

**Temperature Settings:** Control of the heating and cooling services to floors depends on the average temperature on a floor. We adjusted the settings to ensure that they were consistent. If the average temperature is above 24°C, cooling to a floor is enabled. If the average temperature drops below 20°C, heating is enabled. The air handling Fan Coil Units (FCUs) in all offices were set and fixed to the same settings – only cooling when above 24°C and only heating if below 20°C. Computer and server room temperature set points and control systems were altered to keep the room temperatures between 25 and 27°C – previously they had been cooled to 19°C.

**Occupancy Controls:** Occupancy controls were installed in meeting rooms and enclosed offices. The sensors installed will only run the room air-conditioning and lighting while the room is occupied, and only within the buildings core occupancy hours. This means we aren't wasting energy on empty rooms. Investment on these projects has been around £48,000, with annual savings of around £9,000 and emissions reduction of around 49 tonnes per year.

**Variable Speed Drives:** The existing fixed speed drives in our heating and ventilation systems were replaced with variable speed drives (VSDs), which respond to demand needs rather than running at full speed all the time. This helps reduce energy consumption at times of non-peak demand, and is estimated to have reduced our annual GHG emissions by around 26 tonnes.

### Boiler Load Optimisation

In February 2012, we installed two intelligent boiler load optimisation control units to our two gas-fired boilers which provide heating and hot water at 3 Whitehall Place. These units may not look much but they prevent “dry firing” of the boilers, - ensuring that the boilers do not fire up unnecessarily for a light load and so operate at maximum efficiency. We estimate that these gadgets will save us 6 tonnes of carbon a year and over £1000 on our gas bill - this represents a payback of under 4 years.

**Automating BMS adjustments:** The Energy and Carbon Manager monitors the building parameters and adjusts the BMS controls on an ongoing basis to maintain the optimum balance between energy efficiency and staff comfort. These adjustments are being automated - this project won't deliver additional savings, but is intended to ensure that our existing savings can be maintained.

**Free cooling strategy:** The BMS was programmed to pre-cool the building early on summer mornings with the relatively cool outside air. This helps keep the temperature of the building down without having to expend energy on cooling it.

**Air flow to meeting rooms:** We have also been tackling some of the 'cold spots' in 3 Whitehall Place including the meeting rooms located at the corners of the building. Grills have been fitted to the doors of these rooms to allow a flow of air between them and the generally warmer open office areas, and modifications have also been made to duct work in the ceiling void so that warm air is 'sucked' in from the open office. This project is expected to save around 2.5 tonnes of carbon a year as well as improving working conditions for staff.

These are just a selection of the changes we have made to the BMS, and which have helped improve our energy efficiency over the last few years. The overall investment has been around £116,000, with annual savings of £22,000, for an average payback period of just over 5 years. Our annual GHG emissions have been reduced by around 130 tonnes by these projects.

## Carbon Management Plan

While the Greening DECC work was very successful, it was important to embed carbon management more fully into the department's operations. Working with the Carbon Trust's Central Government Carbon Management Scheme, we produced a Carbon Management Plan<sup>3</sup>. This was published in July 2011 and sets out the department's emission reduction plans to March 2015. In addition to continued modifications to the heating, ventilation and lighting control systems, the plans included:

- Further LED lighting installation, extending this lighting to almost all of the non-office space in the building.
- Installation of variable speed drives to heating pumps, so that they use less energy at times of non-peak demand.

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<sup>3</sup> <http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/saving-energy-co2/2130-decc-carbon-management-plan-2011.pdf>

- Installation of a heat recovery system in the kitchens which recycles the heat to the canteen area. This is expected to raise the temperature in the canteen area by 2-3°C. This is not primarily a carbon saving project but a means of increasing staff comfort by addressing the canteen 'cold spot' in the most carbon efficient way.

### Case Study: Lighting

#### Case Study: Lighting

One of the biggest uses of electricity in 3 Whitehall Place was lighting, so this has been one of the key areas targeted by our energy efficiency work over the last few years.

One of the first changes we made to the lighting in 3 Whitehall place was to replace the existing halogen, fluorescent and compact fluorescent lights with LED lights in the lifts, staircases, toilets, basement corridors and communal areas. We also reduced by half the number lights installed in the lifts and staircases.

In addition to installing more efficient lighting, we carried out an in depth audit of our lighting control system. As a result we altered sensor control timings, lighting control groupings and solar impact settings to reflect our office space usage and to ensure lighting automatically dims or goes off when not in use.

Further LED lights were installed in most of the remaining non-office areas as part of the Energy Efficient Whitehall<sup>4</sup> programme in 2011. The cost of our lighting projects up to March 2012 was around £24,000, and the impact has been to reduce our emissions by around 76 tonnes a year. We are considering LED lighting for our office areas, but this will need to guarantee a light quality suitable for working. This technology is developing rapidly, so we are keeping this under review.

### Moving into 55 Whitehall

When the department moved into 55 Whitehall in 2011, we knew there was a significant risk to our emissions reduction plans. It was therefore important that we looked for quick win projects for this building, as we had for 3 Whitehall Place two years earlier.

As before, the most significant savings came from adjustments to the Building Management System. These included:

- Reprogramming the heating, ventilation and lighting control systems
- Installing locking pins on radiator thermostats to ensure optimum temperature settings throughout the building
- Repair of the primary heating control system

The GHG savings from these basic and virtually cost-free projects is estimated at 27 tonnes.

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<sup>4</sup> <http://www.innovateuk.org/competitions/energy-efficient-whitehall.ashx>

## Case Study: IT Chiller

When DECC moved into 3 Whitehall Place, the building had two large 60kW air chillers, which cooled the air for the building. This included the building's server rooms, which meant the chillers were in use 24 hours a day 365 days of the year just to cool the air for a few small rooms.

In late 2010 the department installed a smaller 16kW dedicated server room chiller. This enable us to switch off the cooling to the whole of the building outside of core office hours, including evenings and weekends. This is the most expensive individual project we have undertaken at a cost of £91,000 and yet, given the magnitude of energy savings, will pay back in under five years. The chiller looks to be on track to deliver a saving of 80 to 90 tonnes a year.



Energy Manager Harry Crofts and the IT Chiller

## Future work

DECC are continuing to look for ways to improve the sustainability of the department's estate. We continue to look at renewable energy options, but are still focusing on energy efficiency and energy conservation improvements. With the savings made already though, projects are starting to cost a lot more for every tonne saved, and payback periods are increasing. We are keen to pioneer innovative technology and have piloted the latest LED light technology, intelligent power strips and phase change ceiling tiles, through the Technology Strategy Board's Efficient Whitehall initiative.

Our focus is now turning towards ensuring that our current performance can be maintained, for example through automation of fine controls of the Building Management System at 3 Whitehall Place. However, we are continuing to look for more energy savings where possible. Projects planned or being investigated in 2012/13 include:

- Installation of solar film on the windows of 3 Whitehall Place. This film lets light in but reflects a lot of heat away, helping to reduce the need for air cooling in summer.
- Balancing office air supplies and extracts – this should help reduce hot and cold areas in 3 Whitehall Place and make the system more efficient
- A project to put radiator insulation panels in 55 Whitehall - these are simple reflective strips that reflect heat back away from the walls.
- Investigating the possibility of LED lighting in office areas.
- Printer refresh – this is an IT project to replace our old printers with modern energy efficient ones, which use no energy whilst on standby (see case study below).

## Case Study: Behaviour Change

While the majority of DECC's energy efficiency measures have come from changes to the way we manage the building, we have also tried to achieve savings through staff engagement and behaviour change.

### **CarbonCulture**

CarbonCulture at DECC was a pilot project looking at the use of technology to engage staff and stimulate behaviour change to reduce carbon emissions and drive sustainable outcomes. At the core of the project was a user-led design process that aimed to develop best practice behaviour change techniques in conjunction with accurate real-time data. During this project a range of web-based engagement tools were developed and piloted including applications, games and most importantly the real time energy display which features on our website and intranet.

### **Christmas Floor Closures**

In 2010, we realised there was an opportunity to save energy during the week between Christmas and New Year. As with many offices, the occupancy level is very low in this week, with a large number of staff choosing to take annual leave. So, in consultation with staff, we chose to "close" four of the floors in 3 Whitehall Place, switching off the heating to them and asking staff to work on the other floors. This also had the effect of leaving the (automatic) lights off in any unoccupied areas.

This project worked quite well, saving us an estimated 1 tonne of GHG emissions over the period 29<sup>th</sup> – 30<sup>th</sup> December 2010 – a small but worthwhile contribution. We repeated it during the same period in 2011 (28<sup>th</sup>-30<sup>th</sup> December), closing 5 floors of 3 Whitehall Place, and also switching off the heating to 55 Whitehall altogether (asking staff to work in 3 Whitehall Place instead). We plan to do this every year.

## **Cost Savings**

The department has spent around £500,000 on energy efficiency projects between October 2008 and March 2012.

Based on current energy prices, we estimate we saved around £156,000 in 2011/12 on our energy bills as a result of the savings we have achieved, and expect to see even higher savings in 2012/13.

## Case Study: Printer Refresh

In June 2012 all of our network printers were replaced with newer, faster, more powerful and more energy efficient devices. This was not primarily an energy efficiency project – the old printers were end of life and the new devices are multi-function, and can be used for scanning and photocopying too. Instead of printing to a specific printer, staff now send their work to a printer queue (mono or colour) and then visit any printer in any building and swipe their staff pass to collect the printing.

The new printers save us energy in three main ways:

- they have a lower energy rating than our old printers
- they are multi-function, and more efficient, enabling us to reduce the number of devices on the estate by more than 30%
- they reduce printing by around 10% by requiring staff to swipe their pass before they print – this ensures that documents are not printed but left uncollected.

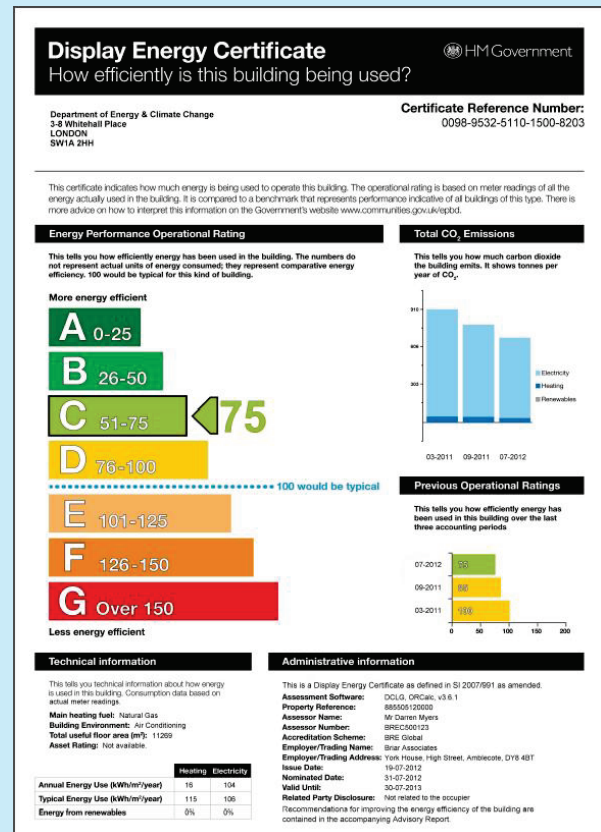
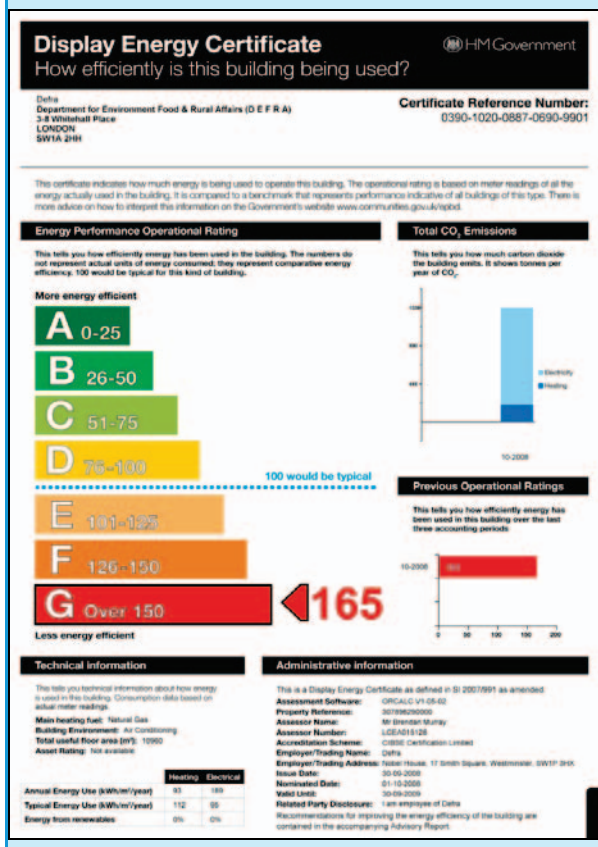
The new printing system is expected to reduce our emissions by around 15 tonnes a year. Other benefits from this project include a reduction in toner and paper costs of about 10%, and a reduction in waste paper of around 4.5 tonnes. We are tracking the level of printing being done, so expect to be able to assess the effectiveness at a later date.

## Annex A: Display Energy Certificates (DECs)

One of the ways in which we have measured our progress on energy efficiency has been through our DEC ratings. Public buildings are required to display a DEC, which represent the energy efficiency of buildings. The rating is calculated based on historical energy use throughout the previous 12 months and is represented as a letter between A and G, with A being the most efficient and G being the least. It is also given a numerical score, which represents comparative energy efficiency. A typical score for a building like 3 Whitehall Place would be 100, which is the boundary between a D and an E. Further information can be found on the Communities and Local Government: Display Energy Certificates web pages<sup>5</sup>.

### 3 Whitehall Place

On 1 October 2008, when DECC first began moving into 3 Whitehall Place, it received a rating of G (with a score of 165) – the lowest. This presented the Department with a challenge to greatly improve the building's efficiency and an opportunity to demonstrate that such changes can be made cost-effectively. Since then we have been working hard to lower DECC's overall carbon emissions and improve the energy efficiency of our London HQ, despite a significant increase in occupancy levels. The building's rating is now C (75), which was awarded in July 2012. This is obviously a significant improvement but work continues to improve the rating further.



<sup>5</sup> <http://www.communities.gov.uk/planningandbuilding/sustainability/energyperformance/displayenergycertificates/>

This table provides the full list of DEC ratings for 3 Whitehall Place since October 2008:

Date	DEC rating	Score
July 2012	C	75
October 2011	D	85
April 2011	D	100
November 2010	E	114
May 2010	E	121
November 2009	F	150
October 2008	G	165

## 55 Whitehall

When DECC moved into 55 Whitehall in 2011, the building had a respectable D-rating, with a score of 79. However, we managed to improve the building's efficiency over the following months, achieving a B rating (with a score of 49) in January 2012.

### Display Energy Certificate

How efficiently is this building being used?

DEFRA  
Department for Environment Food & Rural Affairs (D E F R A)  
55 Whitehall  
LONDON  
SW1A 2EY

**Certificate Reference Number:**  
0380-0310-1649-7100-6092

This certificate indicates how much energy is being used to operate this building. The operational rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret this information on the Government's website [www.communities.gov.uk/epbd](http://www.communities.gov.uk/epbd).

**Energy Performance Operational Rating**

This tells you how efficiently energy has been used in the building. The numbers do not represent actual units of energy consumed; they represent comparative energy efficiency. 100 would be typical for this kind of building.

**More energy efficient**

- A 0-25
- B 26-50
- C 51-75
- D 76-100
- E 101-125
- F 126-150
- G Over 150

**Less energy efficient**

**Total CO<sub>2</sub> Emissions**

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO<sub>2</sub>.

**Previous Operational Ratings**

This tells you how efficiently energy has been used in this building over the last three accounting periods.

**Technical information**

This tells you technical information about how energy is used in this building. Consumption data based on actual meter readings.

Main heating fuel: District Heating  
Building Environment: Heating and Natural Ventilation  
Total useful floor area (m<sup>2</sup>): 2420  
Asset Rating: Not available.

	Heating	Electrical
Annual Energy Use (kWh/m <sup>2</sup> /year)	145	49
Typical Energy Use (kWh/m <sup>2</sup> /year)	122	103
Energy from renewables	0%	0%

**Administrative information**

This is a Display Energy Certificate as defined in SI 2007/991 as amended.

Assessment Software: CLG\_ORCalc v3.0.1  
Property Reference: 874663110000  
Assessor Name: Brendan Murray  
Assessor Number: LCC64915128  
Accreditation Scheme: CIBSE Certification Limited  
Employer/Trading Name: 41 Cornhill Drive  
Employer/Trading Address: Nitral, Menayside, CH3 1 SPY  
Issue Date: 07-10-2010  
Nominated Date: 07-10-2010  
Valid Until: 09-10-2011  
Related Party Disclosure: Employed by the occupier  
Recommendations for improving the energy efficiency of the building are contained in the accompanying Advisory Report.

### Display Energy Certificate

How efficiently is this building being used?

Department of Energy & Climate Change  
55 Whitehall  
LONDON  
SW1A 2EY

**Certificate Reference Number:**  
0580-0312-1649-7109-6006

This certificate indicates how much energy is being used to operate this building. The operational rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret this information on the Government's website [www.communities.gov.uk/epbd](http://www.communities.gov.uk/epbd).

**Energy Performance Operational Rating**

This tells you how efficiently energy has been used in the building. The numbers do not represent actual units of energy consumed; they represent comparative energy efficiency. 100 would be typical for this kind of building.

**More energy efficient**

- A 0-25
- B 26-50
- C 51-75
- D 76-100
- E 101-125
- F 126-150
- G Over 150

**Less energy efficient**

**Total CO<sub>2</sub> Emissions**

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO<sub>2</sub>.

**Previous Operational Ratings**

This tells you how efficiently energy has been used in this building over the last three accounting periods.

**Technical information**

This tells you technical information about how energy is used in this building. Consumption data based on actual meter readings.

Main heating fuel: District Heating  
Building Environment: Heating and Natural Ventilation  
Total useful floor area (m<sup>2</sup>): 3155  
Asset Rating: Not available.

	Heating	Electrical
Annual Energy Use (kWh/m <sup>2</sup> /year)	90	41
Typical Energy Use (kWh/m <sup>2</sup> /year)	120	100
Energy from renewables	0%	0%

**Administrative information**

This is a Display Energy Certificate as defined in SI 2007/991 as amended.

Assessment Software: DCLG\_ORCalc v3.6.1  
Property Reference: 874663110000  
Assessor Name: Darren Myers  
Assessor Number: BRECS00123  
Accreditation Scheme: BRE Global  
Employer/Trading Name: Bjar Associates  
Employer/Trading Address: York House, High Street, Ambicote, DY8 4BT  
Issue Date: 05-01-2012  
Nominated Date: 31-12-2011  
Valid Until: 30-12-2012  
Related Party Disclosure: Not related to the occupier  
Recommendations for improving the energy efficiency of the building are contained in the accompanying Advisory Report.

For both buildings, we do not expect to be able to improve the DEC rating much further, and it will be challenging to maintain their current ratings.

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