

Energy Efficiency in London

How energy efficiency benefits residents and businesses in London



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**Association for the
Conservation of
Energy**

Key Points

The challenge London set itself in its 2011 Climate Change and Energy Strategy is ambitious. To reduce the city's CO₂ emissions, the target for buildings is to retrofit 2.9 million homes; retrofit public buildings comprising a total of 11 million m² of floor space; and retrofit 44 million m² worth of private sector workplaces by 2025. These 55 million m² constitute two thirds of London's current non-domestic stock of buildings. Currently, London is falling well behind on its milestones to 2025¹³, and the rewards of stepping up energy efficiency action in the capital are too good to miss.

Heating, cooling and powering London's homes and workplaces is costly

- London's 3.35 million homes account for 36% of its CO₂ emissions, and every household spends on average £1,175 on gas and electricity bills every year – a total of £3.9 billion. Workplaces – 265,000 buildings – account for 42% of London's emissions, and companies pay a total of £4 billion each year in gas and electricity bills.
- 830,000 homes (a quarter) and 37% of non-domestic buildings that have been given an Energy Performance Certificate since 2009 have the worst energy ratings of E, F or G and are therefore wasting a large proportion of their energy.
- 348,000 London households are considered to be fuel poor. This means they can't afford to keep their homes warm due to a combination of low incomes and high energy costs. In addition to being below the poverty line, each year, they are estimated to have to spend £336 more on their energy than a typical household needs to.

Significant upgrades to the efficiency of London's buildings have been made in recent years

- In homes, energy efficiency programmes have helped to insulate 350,000 lofts and 257,000 cavity walls in London. 803,000 efficient boilers have been installed. Also, London's RE:NEW programme has helped to underpin energy efficiency improvements through advice provision and delivery support in 119,000 homes to date. 400 households have taken up low carbon heating, and 19,000 have installed solar photovoltaic panels.
- Less is known about improvements made in workplaces. Public buildings' Display Energy Certificate ratings have been steadily improving since 2009, and London's RE:FIT programme has underpinned £93m investment in 619 public buildings, cutting annual energy costs by £6.9m. The amount of energy London uses per unit of its economic output has reduced by 40% and its energy consumption has fallen by 16% since 2005.

These improvements bring a wide range of benefits to London

- London's homes and workplaces spend upwards of £7.9 billion on energy bills every year – money which doesn't stay in London's economy. Improving efficiency and cutting energy costs means more invested in and spent on London's economy, while further improving its energy productivity and competitiveness
- Many of these efficiency improvements are delivered by London businesses. An ambitious national retrofit programme for homes, with London taking up its fair share, would support 10,300 jobs in the capital.
- Thermal comfort in the work environment is now well-established as a real boon to workers' health, wellbeing and productivity, and cold homes have been shown to be damaging to both physical and mental health. For every £1 invested in renovating cold homes the NHS saves 42 pence in reduced hospital admissions and GP visits.

Millions of homes and businesses still stand to gain from energy efficiency upgrades. A step-change in delivery is needed, combined with a panoramic view and thorough understanding of all the benefits it can bring. Capturing the above benefits simultaneously, by investing in the energy performance of our buildings, will help London to meet its targets, maintain its economic competitiveness and to be a place that people want – and can afford – to live and work.

Introduction

This report highlights the potential for improved energy performance across London's buildings. 830,000 of the city's 3,350,000 homes are very energy inefficient¹, failing to deliver health and comfort to their inhabitants. Only 34% of the capital's non-domestic buildings deliver high energy productivity for the firms using them²; the energy waste from the remainder limits the competitiveness of London's businesses.

by 2050, relative to 1990, and highlights that almost 80 per cent of the city's emissions result from energy use in its buildings. However, while the Strategy recognised fuel poverty as a key policy area, there is still no London white paper to address it.

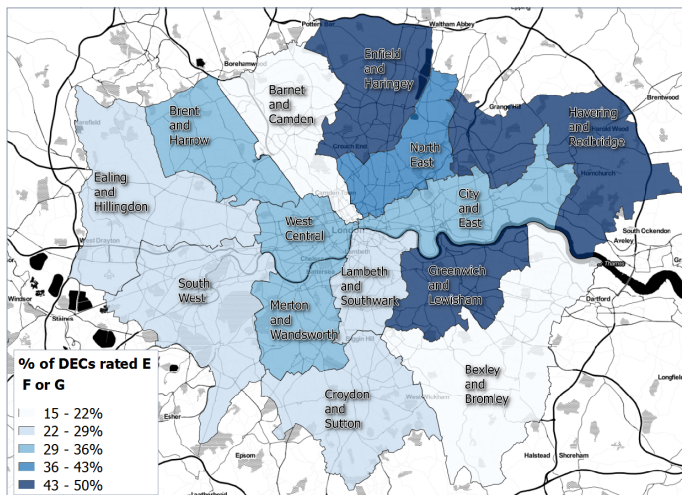
Many of London's local authorities have policies in place to tackle carbon emissions and fuel poverty. Between 2008 and 2011, all but one London Borough identified carbon emissions reduction (either in their own operations or in the local area as a whole) as a priority in their Local Area Agreement, and many have fuel poverty reduction aims in place.

Action on energy efficiency in London has been driven by a mixture of energy supplier obligations, GLA programmes (RE:FIT and RE:NEW) and a multitude of climate mitigation and fuel poverty alleviation initiatives from London's 33 Boroughs. Despite the progress that these have delivered, the challenge remains significant.

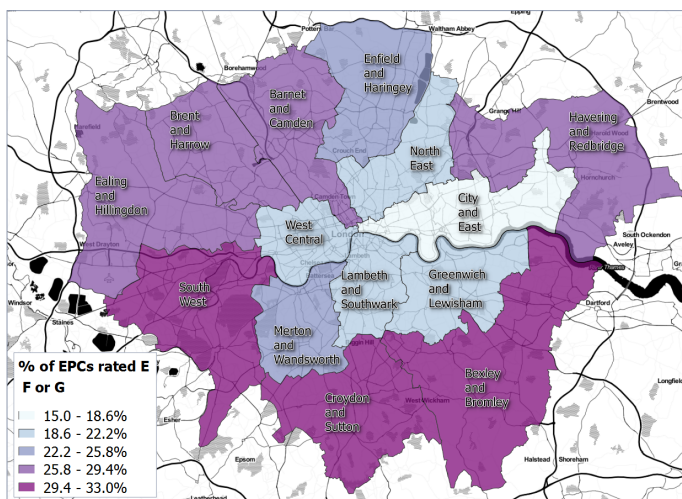
The challenge ahead

The Mayor, in his 2016 Manifesto⁴, pledged to commit London to becoming a zero-carbon city by 2050, and to establish 'Energy for Londoners', an energy services company that would 'help Londoners to generate more low-carbon energy and increase their energy efficiency'. The GLA's London Energy Plan scenarios to 2050⁵ demonstrate clearly that a zero carbon city can only be achieved if heat demand in buildings is minimised and there is a significant reduction in electricity demand from lighting and appliances.

It is now time for London's energy efficiency sector to come together to drive the change needed. The experience gathered from the GLA's programmes and those run by London Boroughs can be combined with the expertise and ideas of businesses and community groups working on energy efficiency to develop a new energy system for London, in which investment in energy demand management plays its full role. If this happens, the capital's buildings will deliver the health, comfort and productivity that will support its continued status as a leading world city.



Percentage of Display Energy Certificates rated E, F or G, by London Assembly constituency²²



Percentage of domestic Energy Performance Certificates rated E, F or G, by London Assembly constituency²²

Energy has been a policy priority for London's government for many years: the first London Energy Plan was published in 2004. The most recent Climate Change Mitigation and Energy Strategy³ set goals for carbon emissions reduction, security of supply and capturing the economic opportunities of the transition to a low carbon capital. It notes the Mayor's target of an 80 per cent reduction in carbon emissions

London today

Energy

Greater London is home to more than 8.5 million people and 976,000 businesses⁶; as a result it consumes a great deal of energy. In 2013 total final energy consumption stood at 132,000 Gigawatt hours⁷ – equivalent to a pile of coal that would cover the One Canada Square tower in Canary Wharf.

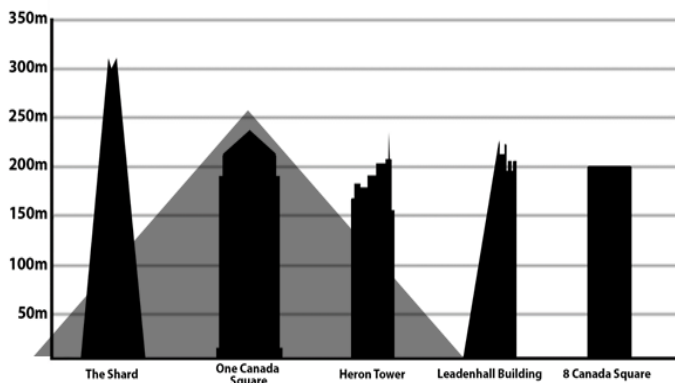


Figure 1: Visualising London's energy use in coal equivalent terms

Of course London is no longer powered by coal; our final energy use breaks down into 47% mains gas,

mostly used to provide heat and hot water to our homes and businesses, 31% electricity, and 22% road fuels and solid fuels used in industrial processes.

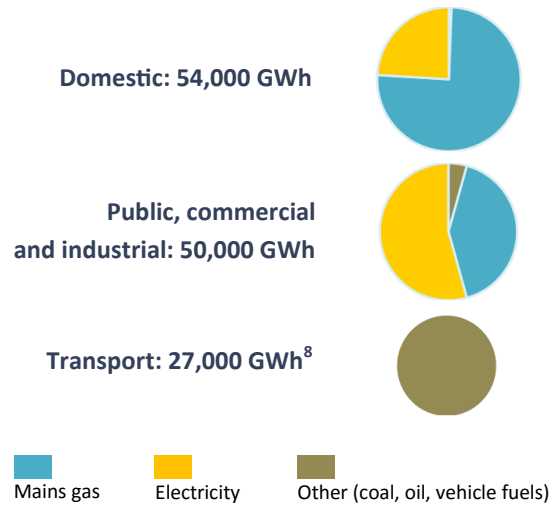
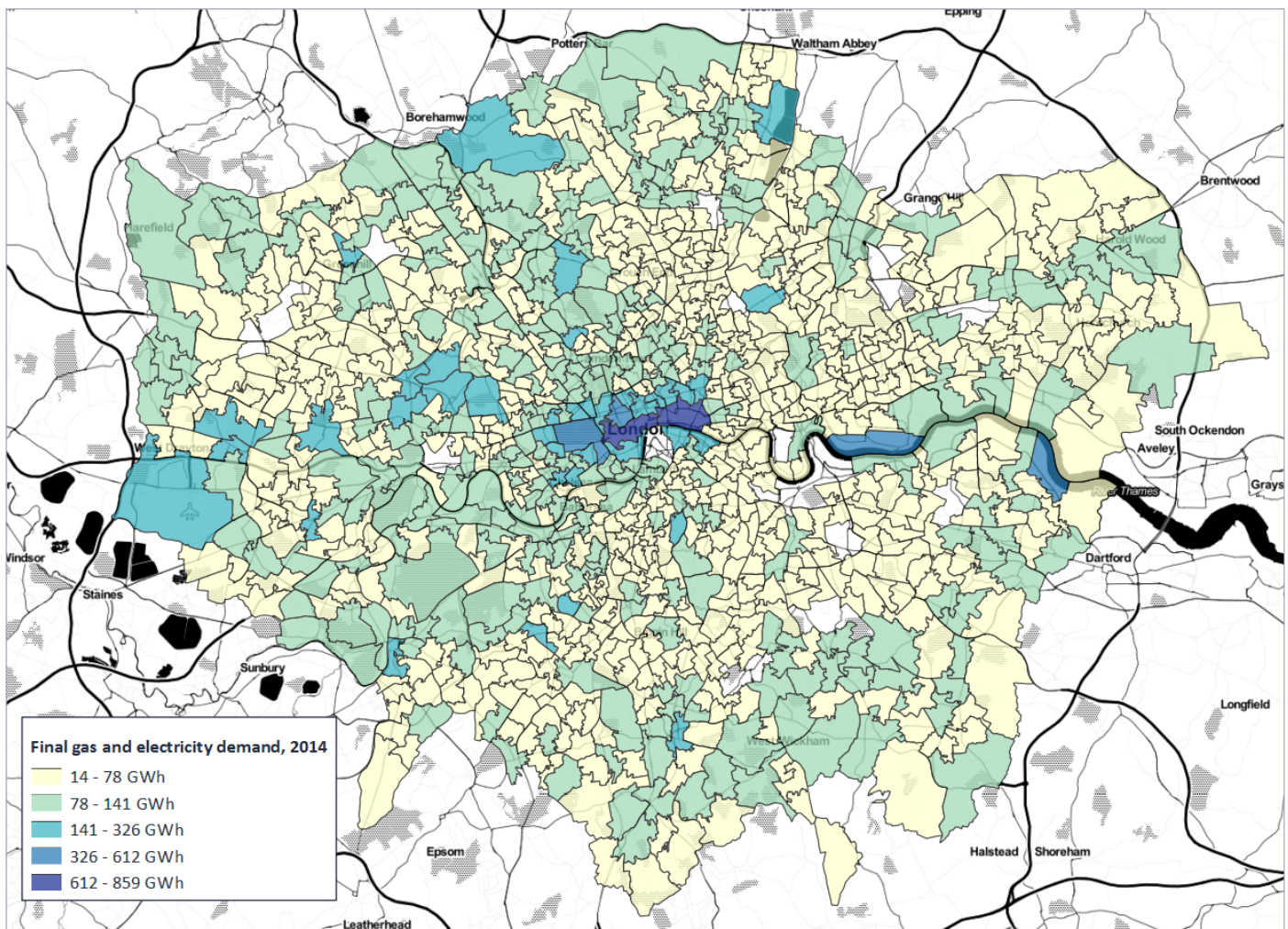


Figure 2: London final energy demand breakdown

Total gas and electricity consumption is split fairly across both domestic and business users with the majority of other fuel used to drive private transportation.

Figure 3: London's final gas and electricity demand in GWh by Middle Super Output Area, 2014⁹



London today

Buildings

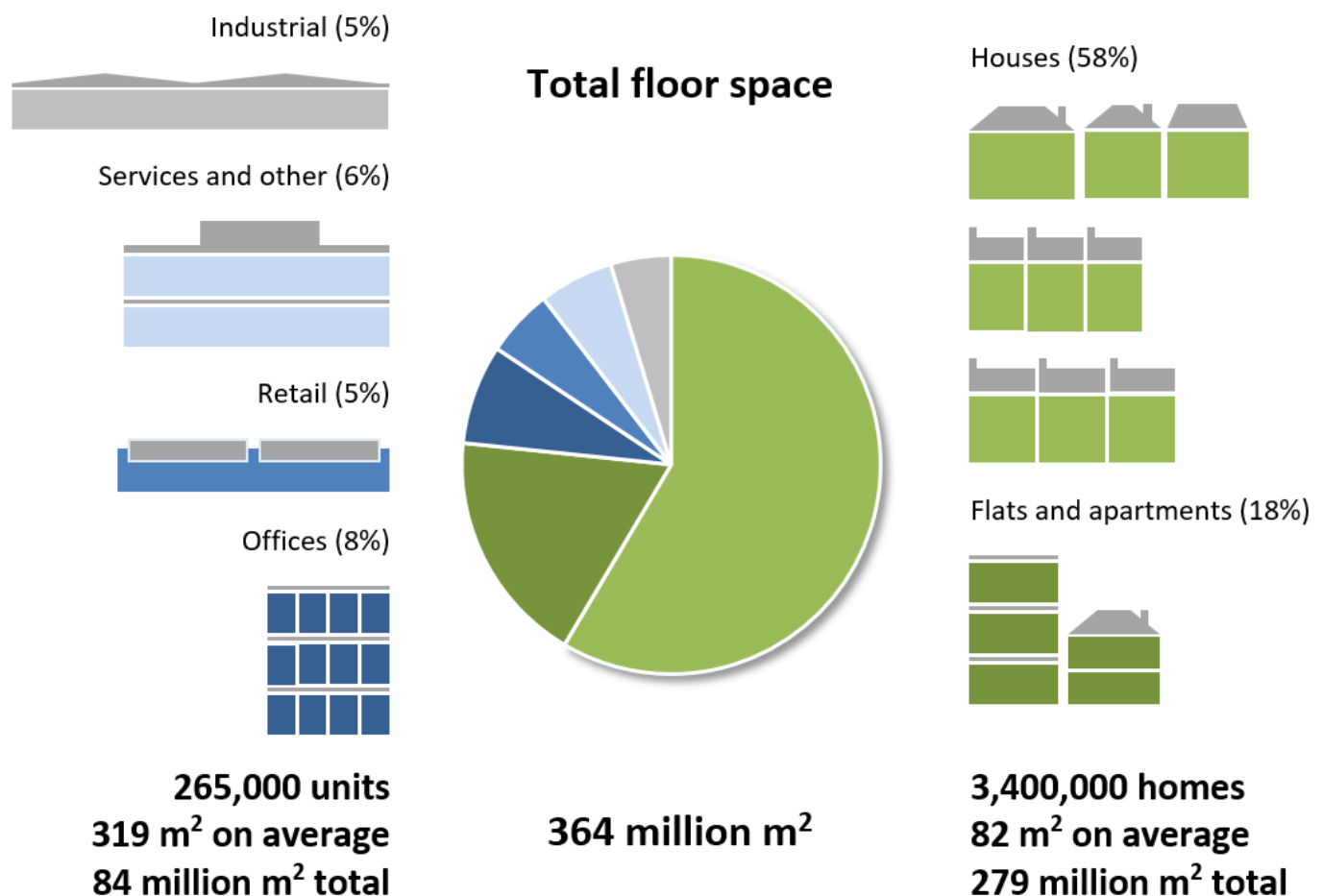
The homes that Londoners live in and the buildings where they work are a significant driver of the amount of energy used by the city. A better insulated building needs less energy to keep it at a comfortable temperature. Efficient and well maintained heating, ventilation, hot water and lighting services also help to keep running costs down, whether at home or at work.

Making London an energy efficient city means tackling its diverse stock of buildings. A typical view of London's urban landscape will encompass Victorian terraces, 1950s semis, post-war tower blocks and gleaming skyscrapers. It can be hard to know where the biggest challenges and opportunities lie: for example, how much we can save by tackling commercial offices with their lights on all night compared with improving the under-insulated loft spaces of our own homes.

Renovating London's building stock is undoubtedly a big challenge. However, it is possible get a better perspective on the scale of the job by breaking down the stock by building type. The Valuation Office Agency has detailed records of the size and use of business properties in the capital. Detailed data on the housing stock is regularly updated as part of the annual English Housing Survey.

The diagram below shows how London's stock of buildings is broken down between different uses; houses and flats making up more than three quarters of the stock by floor area. The next two sections provide more detail of the stock, focusing on the energy efficiency opportunities to be found in the residential sector and then in non-domestic buildings.

Figure 4: Breakdown of London's building floor-space by use¹⁰



Homes

Challenges

The price of gas and electricity to London households is 30% higher than it was in 2010 and double what it was ten years ago¹¹. Every year Londoners spend £3.9 billion on their gas and electricity bills, with the annual average energy bill for London households at £1,175¹². The CO₂ emissions associated with this energy consumption make up 36% of London's total¹³.

The majority of London's homes were built long before good insulation standards were a requirement for new homes. Older homes with insufficient insulation can be expensive to run and difficult to maintain at a comfortable temperature in the winter. A quarter (830,000) of London's homes have the worst energy efficiency ratings of E, F or G (on the A to G scale)¹⁴.

Over 53% of London homes were constructed before WWII, compared to a national average of 34%. Of all the English regions, London has the second-highest proportion of solid-walled properties. The vast majority of these have no wall insulation as they are more challenging to improve than cavity

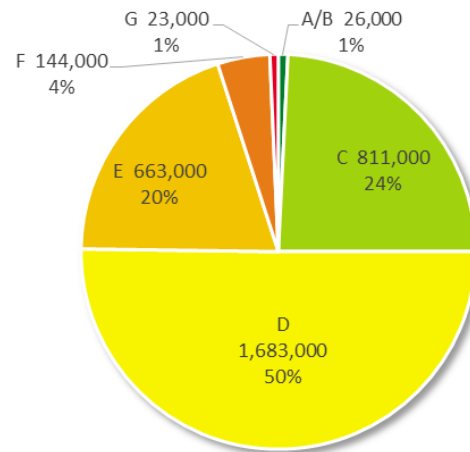
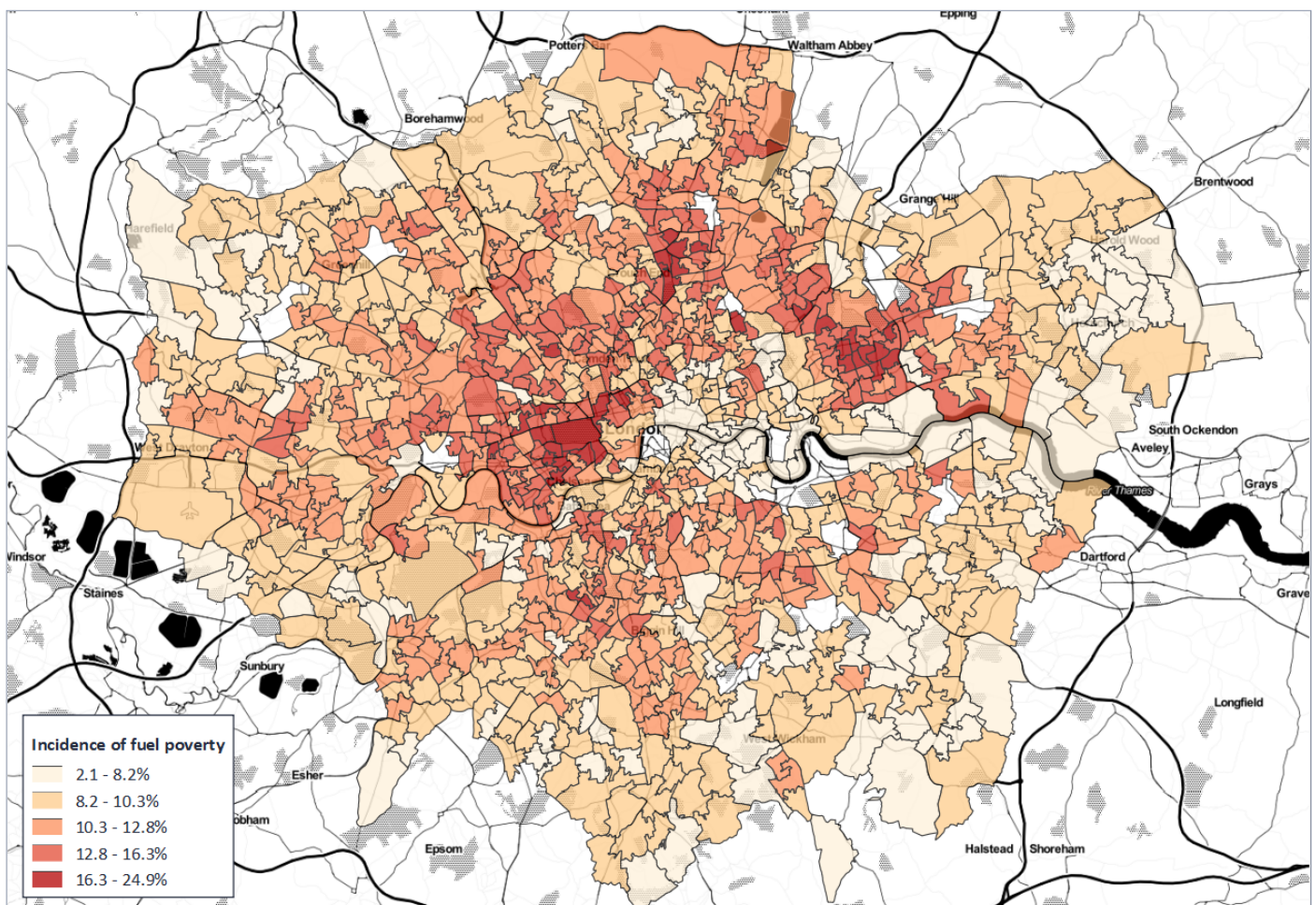


Figure 5: Energy performance ratings of homes in London

walls. In addition, London has the highest proportion of private renters – 28% of households compared to a national average of 19% – whose landlords are less likely than owner occupiers to address the energy efficiency of their properties as they do not pay the bills.

10.6% of London's households were fuel poor in 2014: equal to the English average. These 348,000 households represent 14.6% of all fuel poor households in England. In addition to being below the poverty line, each year, they are estimated to have to spend £336 more on their energy than a typical household needs to¹⁵.

Figure 6: London's incidence of fuel poverty by Middle Super Output Area, 2014¹⁶



Poor housing quality and low incomes can all too easily result in an unhealthy indoor environment. Depending on the vulnerabilities faced by householders, this can increase the risk of respiratory and cardiovascular illness, depression and anxiety, and

is also known to contribute to excess winter deaths¹⁷. Several schemes in London have been set up to tackle the complex interrelated problems of poor housing and poor health. Islington's Seasonal Health Intervention Network is highlighted below.

Islington's Seasonal Health Intervention Network (SHINE)

The London Borough of Islington's Seasonal Health Intervention Network (SHINE) is the largest fuel poverty referral network in the UK – an exemplar programme being emulated by other areas across England. Learnings from the SHINE project are now included in NICE's guideline on reducing excess winter deaths and illness.

SHINE provides a single point referral service that now links up 100 organisations working in the borough in an integrated approach to tackling fuel poverty. The concept was that those in fuel poverty often face other problems relating to their health or finances and so could well come to the attention of some other agency (such as the local NHS) first. The single point referral service allows those in need to be brought to the attention of the SHINE Hub who can then offer a broad range of services and interventions.



Once a household is identified as needing advice or support on keeping their home at a safe and comfortable temperature, SHINE offers a range of affordable warmth services. Energy bill discounts are secured for most clients and around half will receive an intensive *Energy Doctor in the Home* visit, whereby they are given in-home, tailored advice on saving energy and a package of smaller energy saving measures. A number of clients – typically those with the most complex health needs – also benefit from a *Warmth on Prescription* package, having heating and insulation measures installed in their homes.

Support is not however limited to energy saving advice. Other services that SHINE offer include home maintenance, fire safety, medication reviews, befriending services and dealing with health problems. SHINE aims to place fuel poverty firmly in its health and wellbeing context.

The Council's Seasonal Health & Affordable Warmth Coordinator, John Kolm-Murray, explains some of the challenges that SHINE faces and how they can be overcome:

"Barriers faced by SHINE include the lack of alignment between the housing and health agendas. Whilst some health professionals, notably those working in respiratory or mental health services, are very engaged, the full extent of cold, damp housing and its impact on health is not sufficiently appreciated. Related to this is the lack of national funding for fabric interventions targeted at those with greatest health need. ECO does not currently take into account health and social care savings therefore we cannot guarantee funded works for those referred to us. The nature of Islington's housing stock – mostly older and solid-walled – means that our homes are expensive to improve but the greatest fuel poverty is faced by people living in such homes."

"Greater participation from health and social care partners would allow us to target those in greatest need even more. The nature of health services means that many hospitals do not align with borough boundaries so having a consistent offer, like SHINE, to health and social care professionals across London would raise the overall profile of the challenge and lead to greater engagement. The allocation of a significant portion of energy efficiency funding to those with greatest health needs, on the basis that health and social care savings are realised alongside energy bill ones, would also be of immense value. A guarantee of works for those most vulnerable would also put housing improvements on a par with more medical interventions. Much of this in London may need to be focused on older housing, generally neglected by existing funding streams such as ECO."

"For cold homes and vulnerable people we would favour an approach of worst first, sickest quickest, and this will require a robust partnership across housing and health backed by adequate funding."



The story so far

To combat historically high energy prices and one of the oldest housing stocks in the country, companies in the energy efficiency sector have been working hard to keep bills in check and Londoners' homes comfortable.

Significant upgrades to the efficiency of homes in London have been made in recent years. We estimate that since 2005 more than 1,430,000 significant works have been undertaken to improve the energy performance of homes in London¹⁸.

Table 1: Estimated number of common efficiency improvements made to homes in London since 2005

Lofts insulated	350,000
Cavity walls insulated	257,000
Efficient boilers installed	803,000

Much of this work has taken place through national programmes – fuel poverty grants and energy supplier obligations – often complemented by local authority schemes and, since 2009, by the GLA's RE:NEW programme. The latter has helped to underpin energy efficiency improvements through advice provision and delivery support in 119,000 homes to date¹⁹.

The London Boiler Cashback scheme launched in February 2016 and offers a £400 refund to home owners or landlords who replace inefficient old boilers with new A-rated models. The scheme has funding to help 6,500 applicants on a first-come first-served basis. The scheme has proven popular with 6,900 applicants to the scheme and 1,500 claims made to date²⁰.

Less widely deployed insulation technologies such as cladding for solid walls have also greatly benefited older homes and post-war tower blocks and estates.

In addition London residents have taken advantage of incentives that enable them to generate their own electricity and low-carbon heat.

Table 2: Low carbon technologies installed in London homes since 2010²¹

Low carbon heating	395
Solar photovoltaic systems	19,043

National policies have played an important role at the local level, as has the GLA. Ultimately, the dedication of local authorities, businesses and delivery agents, combined with national funding, support

and incentive schemes, have been pivotal in the progress made so far in London.

Untapped potential

A promising start has been made to investing in modernising heating systems and insulation in London, but there are huge opportunities still remaining and many households that have yet to benefit.

Detailed surveys of 1,604 homes representing London's housing stock were conducted as part of a nationwide housing survey. Surveyors identified a range of opportunities to improve energy efficiency in the homes they visited.

Table 3: Number of homes in London that could benefit from basic energy efficiency measures¹⁴

Could improve the level of insulation in their lofts	674,000
Could benefit from cavity wall insulation	650,000
Could benefit from solid wall insulation	880,000
Could improve the efficiency of their heating systems	1,300,000

Despite the significant potential, local practitioners have found that changes to national energy efficiency schemes in the last few years have meant that funding for low income households is harder to get hold of and incentives for 'able to pay' households to undertake costlier upgrades are no longer available (London's short-term Boiler Cashback scheme aside). Moreover, London has historically secured less than its fair share of supplier obligation funding, owing to a combination of higher costs and a range of non-financial barriers.

There are 2.4 million homes in London with an Energy Performance Rating of D or worse that could benefit from improved efficiency. One third of these have the worst ratings of E, F or G and are likely to be in urgent need of attention¹⁴.

Upgrading the energy efficiency of these homes would present a huge opportunity to cut bills, improve residents' health, comfort and well-being, and boost the local economy. To make this happen, action is needed locally, regionally and nationally.

Smart Homes

by Sadhbh Ní Hógáin, Housing Retrofit Project Manager, Haringey Council

Haringey's Smart Homes Project was funded by the Department of Energy and Climate Change, started in late 2014 and is now in its final phase. We have managed this project on behalf of Camden, Enfield, Islington, Waltham Forest and Hackney Councils, delivering the benefit and economies of scale across the North London boroughs.

Smart Homes' aim is to deliver incentives to drive uptake of solid wall insulation alongside other energy efficiency measures. At the same time we want to increase awareness of energy efficiency, reduce energy consumption and carbon emissions to deliver the boroughs' carbon targets. Key to achieving these targets is retrofitting existing homes, as homes account for approximately 50% of Haringey's carbon footprint. But alongside this project, energy retrofit of homes presents an economic opportunity for local businesses and home owners.

Residents in the Smart Homes project were offered a grant of £6,000 for solid wall insulation, or up to £3,000 for heating and windows upgrades. To receive the grants they were required to contribute at least 25% extra to the total cost of the works. The Smart Homes project received over 5,000 expressions of interest through the advice line, demonstrating a high interest in retrofit and energy efficiency in the boroughs. Over 20% of these calls moved from interest to installation, which shows that the homeowners' market is there but needs support to enable action.

To deliver a more coordinated plan and smoother customer journey the project worked with InstaGroup and London-based members of their Snug Network to provide home energy assessments and energy efficiency products to homeowners, and with ECD Architects - as Retrofit Coordinators - to provide technical oversight and advice. The Retrofit Coordinator's role included checking that quotations offered value-for-money, advising installers and householders of technical risks, and developing a standard installation approach across the installer network.

The Council supported the local supply chain through the development of a 'RetrofitWorks Cooperative', now comprising over 30 locally approved installers. This ensured the economic benefit (jobs and skills) of the project was captured locally. These local companies are delivering a high standard of service and are leading the way on many installations. This has led to retaining existing jobs and creating new short-term employment opportunities. These local jobs are skilled trade jobs that the borough may have lost or would never have been created without this project, which helps the Council deliver its economic growth targets. Alongside the installation process, Haringey's community groups focusing on energy and energy efficiency were actively working alongside Smart Homes by delivering energy advice and promoting the scheme.

One installer advised "We directly employed 3 extra people in the office for the whole of 2015. *"While another installer said "As a direct result of Smart Homes we increased delivery teams from 7 teams with 3 people to 12 teams of 3 people."* Over 38% of all Smart Homes installations were undertaken by North London-based installers.

To date over 1,250 grants have been awarded to residents, businesses and landlords to install energy measures. Works range from whole house retrofit to single measures such as external wall insulation, high performance windows, high efficiency boilers and under-floor insulation.

The installations have received positive feedback with residents able to reduce their energy usage. This gives residents greater freedom to spend on other priorities while delivering better, more valuable and warmer homes.

"It's really improved how we feel about the house – we couldn't live with the cold. Our energy bills are down to £15 a month." (Haringey resident)



Installation in progress and finished installation at Wood Street, Waltham Forest

Seven individual blocks of flats have installed solid wall insulation alongside other measures. These blocks have ranged from six units to 66 units. Ecologic Energy, a member of the Snug Network, installed external wall insulation at a block of 38 units owned by the Wood Street Cooperative as well as a damp proof course and fixed external plumbing.

"This [Smart Homes] substantial grant has allowed us to press forward with works that have needed to be done for some years. However, we were conscious of the costs involved, and with no funding much hardship would have been caused to many owners." (Wood Street resident feedback)

The project overcame several major challenges including: ambiguity of Permitted Development Guidance on external wall insulation; the impact of inconsistent energy policy from government leaders; communicating the benefits of installing solid wall insulation and energy efficiency measures especially in the private rented sector; variance in the standard of finished installation quality across installers; and the challenge of delivering carbon saving projects during a period of financial austerity.

Non-domestic buildings

Challenges

Businesses have also felt the impact of high energy costs in the capital. Business energy prices are 30% higher than in 2010 and have doubled since 2005. Every year London businesses spend £4 billion on their gas and electricity bills²², impacting on their bottom lines and their competitiveness. Many of the buildings that London's businesses operate out of are old and poorly insulated, with only 34% having achieved an energy performance rating of C or higher²². Buildings with poor energy performance can be expensive to run, affecting business competitiveness, and making it difficult to maintain a comfortable working environment for employees, which in turn affects their productivity and a company's ability to retain its best staff.

Commercial and industrial buildings make up around a quarter of London's building space but consume almost half the energy. The stock comprises around 265,000 units with an average floor area of 319 m². This includes 107,000 retail units, 90,000 office units and 43,000 industrial units. The remaining 25,000 are mostly school and university buildings, hospitals and healthcare, and a wide variety of buildings used for leisure such as cinemas²⁴. At 42%, London's workplaces account for the largest share of the city's CO₂ emissions¹³.

The majority of London's commercial premises were built long before good insulation standards were required. By floor area, 31% of commercial buildings were built before 1940 and 73% were built before standards were improved in the early 90s²⁵.

Older buildings with insufficient insulation can be expensive to run and difficult to maintain at a com-

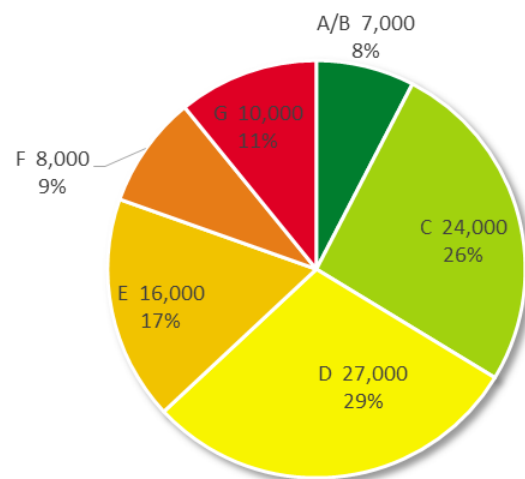


Figure 7: EPC ratings of non-domestic buildings in London

fortable temperature in the winter or can overheat in the summer. A recent poll by Ipsos Mori found that 45% of UK office workers were dissatisfied with the room temperature at work²⁶.

Commercial and industrial buildings are required to have an Energy Performance Certificate (EPC) if they are sold or let to a new tenant. Since 2009, 93,000 EPCs have been lodged for non-domestic buildings. Of these certificates, two thirds received an efficiency rating of D or worse²³.

Public buildings like schools and hospitals can use a significant amount of energy. However, they are well placed to demonstrate best practice in low energy buildings and provide a leadership role for building energy management. For these reasons larger public buildings are required to publicly report on their energy use with a Display Energy Certificate. 3,667 of London's public buildings reported their energy consumption in 2015: only 7% received the best ratings of A or B whilst 33% scored the worst ratings of E, F or G²³.

Global Action Plan's Operation TLC

Operation TLC is an internationally recognised, award-winning behaviour change programme that helps staff take action to better manage healthcare buildings. The programme was pioneered by Barts Health NHS Trust in partnership with Global Action Plan in 2012, when building audits and staff consultation identified that energy was used unnecessarily due to staff practices. The programme has since been implemented at six NHS Trusts across the UK, saving 2,155 tonnes of CO₂ and reducing NHS electricity bills by over £500,000 per annum out of a total £17m bill. Action has spread across London, with Barts Health, King's College and Great Ormond Street Hospital NHS Trusts improving patient experience in hospitals in the boroughs of Waltham Forest, Newham, Tower Hamlets, the City of London, Camden, and Lambeth.

Operation TLC works because it harnesses the positive efforts of staff to give patients the best possible care. The programme applies that patient focus to the building, asking staff to consider how the control of buildings can create a healing environment for patients. As well as tender loving care, TLC also stands for Turning equipment off, Lights out and Controlling heating, doors and windows. For example, academic studies prove the benefits that healing environments bring to patients:

- Exposure to artificial light reduces sleepiness, increases alertness and disrupts sleep.
- Patients who receive more natural light see a 22% decrease in painkilling medicine use and analgesic medication compared to those who spend more time in artificial lighting (Joseph, 2006; Walch et al., 2005).
- Patients on mental health wards were found to have an average of 3.67 day shorter hospital stays when staying in sunlit rooms (AHRQ, 2005).



The story so far

Larger public buildings in London are required to update their display energy certificates (DECs) every year. This allows the buildings' occupants to track their energy consumption over time and helps to highlight high energy consumption. Data from these certificates have shown a steady reduction in the number of poorly performing buildings in London. When DECs were first introduced in 2008 11% scored an F and 22% scored G²³, as shown in Figure 8.

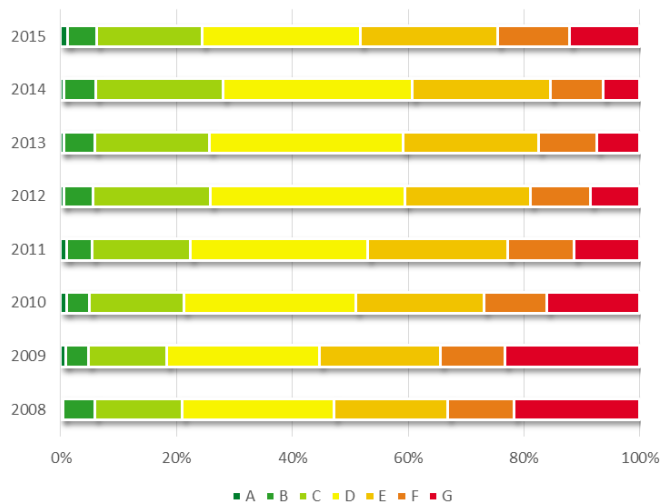


Figure 8: DEC ratings of public buildings in London

By 2014 the number of G-rated buildings was down to just 6% and Fs were down to 9%. In 2015, changes to DEC requirements meant that a large number of smaller buildings were required to get a DEC for the first time. This caused an increase in the number of F and G-rated buildings, and it will be interesting to see if the improving trends seen so far can be applied to the wider range of smaller public build-

ings now part of the scheme.

Emphasising the need for the public sector to show leadership in energy efficiency, RE:FIT was set up by the GLA in 2009 to support the implementation of energy efficiency projects in London's public sector buildings. It also provides a procurement framework for energy performance contracting. Since 2009, RE:FIT London has supported 619 buildings for retrofit, resulting in £93m invested in projects, cutting annual energy costs by £6.9m and saving 119,000 tonnes of CO₂ emissions²⁷.

In the sector more widely, and as Figure 9 shows, London's energy productivity has been steadily improving. As the next pages show, there is a real opportunity for London's non-domestic sector to drive an even more dramatic decoupling of energy consumption from economic growth.

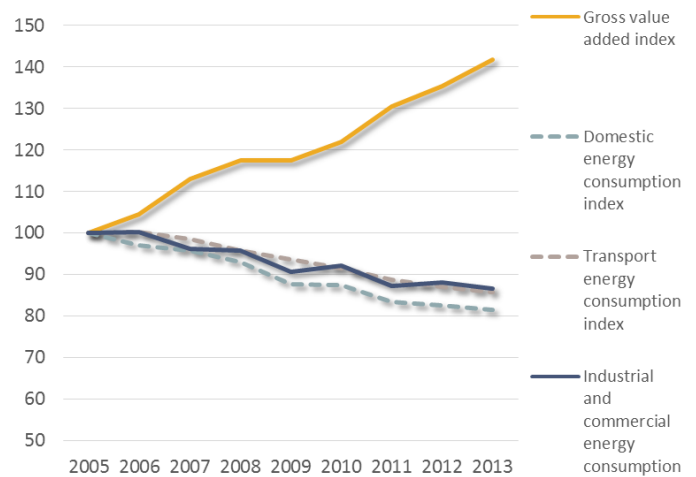


Figure 9: London energy consumption and GVA, indexed to 2005 (= 100)²⁸

Public sector leadership: West London Alliance and RE:FIT

The West London Alliance (WLA) is a partnership of six west London councils: Barnet, Brent, Ealing, Harrow, Hillingdon and Hounslow. In 2013, it signed up to the GLA's building retrofit scheme RE:FIT. The WLA's collaborative retrofit project also involved three further neighbouring local authorities: Westminster City Council, London Borough of Hammersmith and Fulham and the Royal Borough of Kensington and Chelsea.

The GLA's RE:FIT scheme supports public sector organisations by providing pre-negotiated, EU regulation compliant contracts that can be used with a group of pre-qualified Energy Service Companies. It also provides free of charge support, from its Programme Delivery Unit (PDU), to help organisations get energy efficiency retrofit projects and programmes up, running and successfully implemented.

Through RE:FIT, the partnership has employed an energy service company (ESCO) to put in place energy conservation measures, including: lighting and controls upgrades, loft and cavity wall insulation and solar photovoltaic systems.

The measures installed have helped the partnership achieve a 28 per cent reduction in energy consumption. This saves the partnership £ 98,700 in energy costs every year and results in an annual saving of 595 tonnes of carbon. The initial capital investment of £730,000 means the programme has achieved a seven year payback period.

What has made the WLA's retrofit programme so successful, and is particularly innovative, is that they have taken a portfolio approach across multiple boroughs on a year by year basis. Their single procurement competition and shared project co-ordinator greatly increased the efficiency of the programme, which has resulted in a continuity of work offered to their contractors. This has resulted in reduced costs and has allowed improvements to be made in both larger and smaller buildings. In recognition of their success, the West London Energy Managers were given the 'Best energy performance contracting' 2015 award from European Commission's Intelligent Energy Europe programme (pictured).



Public sector leadership: Sir George Monoux Sixth Form College

Sir George Monoux Sixth Form College, in Walthamstow, shows how teenagers can be inspired to save energy, and how reduced spending on energy provides schools with money that can be spent on education. The College has a goal of becoming carbon neutral. To progress towards this, it has an interim target of a 34% reduction in CO2 emissions by 2020, in line with national Climate Change legislation.



The College has installed condensing boilers, improved insulation and fitted LED lighting across 70% of the site. They have also introduced a building management system that allows separate control of different areas of the College. Air conditioning units have been fitted with timers to reduce unnecessary usage.

A 50kWp solar PV array has also been installed and an Eco Gym constructed, which enables students to charge mobile phones whilst exercising. Furthermore the College has looked to improve the ecology of the site, by redeveloping the gardens at the College to encourage wildlife and cross-pollination, planting over 30 fruit trees and installing a bee apiary which will produce honey.



Challenges

The main barrier encountered by the College is the increasing number of information technology resources needed to deliver teaching to the highest level. The modern school needs electronic whiteboards, printers, laptops, tablets, all of which consume energy and increase energy costs and carbon emissions.

Installing eco-friendly equipment and upgrading facilities is a relatively simple task. The real challenge lies in 'culture change' – inspiring students and staff to adjust their everyday behaviours in order to save energy, for example switching off lights and printing less.

It is a challenge for schools to allocate funding for green projects at a time when education budgets are being cut.



Benefits

Annual daytime electricity consumption decreased by almost 10% over a three year period, and gas use decreased by around 1.5% over the same period.

With combined Feed-in Tariffs and energy created by solar panels, the College has saved a significant sum. Around £70,000 has been given to the College from Feed-in Tariffs, which has gone on to fund student scholarships. Approximately £8000 per year is saved on energy costs through using solar panels to power the building supported by the PV System.

Sustainable energy has also been integrated into the curriculum, including in Maths, Geography and Science; the students can be involved as members of an Eco Committee (which looks good on their CVs) and the College is engaging with local partner schools to provide workshops on sustainability. Income from the Feed-in-Tariff from the solar PV is being used for bursaries and to offer scholarships to 10 students each year.



Going further

The College would benefit from access to localised advocates of green technology. There are many institutions using green energy and implementing innovative ideas, but at present these are disconnected. It would be a major benefit to be able to network and share thinking to build upon what the College has done and to support others at the beginning of their green journeys.

The College says it has reached a stage where it has completed most of the necessary building upgrade projects within its financial constraints. To move forward it would need to undertake larger-scale projects which require more funding.

Untapped potential

Despite improvements to the energy efficiency of London's non-domestic buildings there is still a vast opportunity remaining to make further savings. There are 61,000 buildings with EPC ratings of D or worse that would be likely to benefit from improvements to their fabric and energy services. Of these, 18,000 buildings are rated F or G, meaning that they are very inefficient and likely to be wasting a large amount of energy. Hopefully, a significant number of the latter will be tackled as a result of mandatory minimum standards for the private-rented sector. For London to be a leading city, prioritising the worst-performing buildings is essential, but far from enough on its own.

The non-domestic building stock is extremely diverse so a wide range of solutions are needed to address their energy consumption. Innovative approaches, such as those highlighted in our case studies of Open Energi and Demand Logic, for example, are required as well as more traditional fabric refurbishment.

The whole range of case studies featured in this report from innovative London businesses and initiatives – not just those tackling the non-domestic sector, but also those addressing energy efficiency in homes – demonstrates that the know-how and ingenuity is out there. With the right support London is well placed to be a world leader in building energy refurbishment.

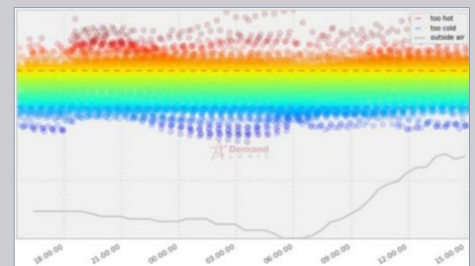
Demand Logic: an energy management clean tech start-up

In 2013, Demand Logic, a London-based clean tech start-up, launched a cloud-based system that plugs into a Building Management System (BMS) and quickly identifies what Mike Darby (Demand Logic's co-founder) describes as "energy insanities". These include rooms being heated and cooled at the same time, or faulty equipment being left on 24/7 - issues likened to finding a needle in a haystack because of the high volume of data being generated, but then lost, by a typical BMS. Demand Logic's software records and analyses the data from the BMS, producing live graphics and prioritised tables of equipment and building performance. Building managers can log on to see these graphics via a social media platform and then develop a plan to fix them.



Demand Logic target those owning, managing, or occupying commercial buildings that either have or would benefit from a BMS, including blue chip companies, public sector organisations and universities.

Demand Logic say their system results in average energy cost savings of 10 to 30% with an average payback of less than nine months. The Better Buildings Partnership (BBP) estimated that Demand Logic's tools save 11,800 tonnes of CO₂ each year and help deliver £1.8 million energy cost savings annually for BBP's members and occupiers*. The other key benefits are around comfort, productivity and improved maintenance. In one case they enabled a 50% reduction in helpdesk complaints about temperature comfort. A key facilities management partner estimates maintenance savings of over 50% compared to traditional approaches.



With these sorts of financial savings and occupant benefits, it is understandable that Demand Logic business has been growing rapidly over the past few years. However, a source of frustration to the team is that in many sectors, there is still a relatively low awareness of these energy saving opportunities. In addition, the decisions to invest in energy efficiency are often left to isolated and under-resourced individuals.

Mike Darby says: "Commercial buildings have been generating a wealth of data since the advent of Building Management Systems in the late 1980s, but this data has been largely lost and virtually impossible for a human to analyse. We're showing that with the right tools and the right team huge energy savings and greatly improved comfort conditions can be attained without major capital investment. However, in many UK properties no-one is incentivised to take even these light-touch measures, as energy costs are often directly passed on to tenants, who have no knowledge of how well or badly their building is performing."

* BBP case study: *Members Use Big Data to Improve Comfort and Efficiency*, www.betterbuildingspartnership.co.uk/bbp-members-use-big-data-improve-comfort-and-efficiency

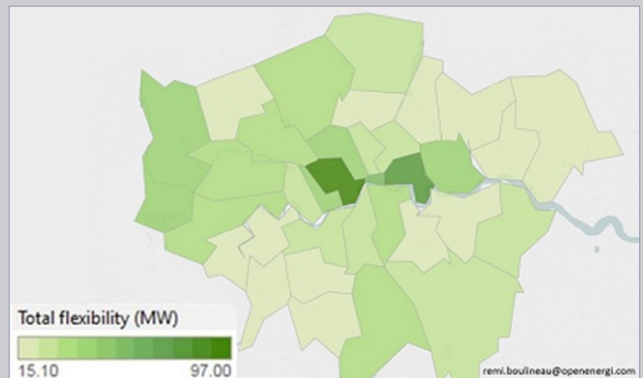
Open Energi: capturing the potential for demand response

Open Energi is a London-based clean technology company which since 2011 has been integrating its innovative demand response technology in businesses in London and across the UK. Its technology – called Dynamic Demand - allows businesses with flexible loads to continuously adjust their electricity usage to adapt to peaks and troughs in demand and supply across the grid without affecting operational performance. Open Energi say their technology not only allows businesses to earn revenues equivalent to 5 to 10% of their energy bill, but that it also helps National Grid avoid the use of expensive, polluting fossil fuel-fired power plants and manage greater levels of renewable generation, with knock-on benefits for the consumer.

Currently, Open Energi is connected to around 60 MW of flexible electricity demand across its customers' sites, of which around a third is usually available to 'flex' its consumption up or down at any moment in time. This includes: Aggregate Industries' and Tarmac's bitumen tanks; United Utilities' pumps and motors, and Sainsbury's heating and cooling systems. Together, these organisations are cutting UK carbon emissions by approximately 38,700 tonnes of CO₂e per yearⁱ.

The opportunity for London

Looking to the future, London's population is predicted to rise from 8.6 million to 11.3 million by 2050 with associated rises in electricity demand. New modelling by Open Energiⁱⁱ demonstrates that London has a whole gigawatt of 'spare' capacity in its current demand for energy. Demand side response is an efficient way to optimise the existing generation infrastructure – shifting 1GW out of the peak would save the need to build a new power plant equivalent to the size of Barking Power station. In terms of cost, they say their technology is typically 20-25 times cheaper than new generation.



Lucy Symons, Policy Manager for Open Energi commented: "As London expands there is a huge opportunity to unlock the city's flexible energy demand and drive major cost and carbon savings for Londoners. We hope that the Mayor recognises the benefits of a smarter, no-build approach to meeting London's energy needs as he develops his plans for the city's future."

Taking things forward

On barriers Open Energi have encountered, she said: "Whilst awareness of demand response is growing there are still misconceptions about what it means for businesses and some confusion around the different types of demand response, which can result in inaction. However, momentum in the market has grown significantly in the last 12-18 months – boosted by the launch of National Grid's Power Responsive campaign – and as more businesses adopt the technology and demonstrate what is possible, take-up is growing."

Lucy explained what in her opinion would allow for demand response technologies such as Dynamic Demand to achieve their potential: "To support innovation, disruptors must be able to implement their solutions on a free-market basis, without guarantees and subsidies for certain technologies that block competition. An energy department with the aim of enabling innovation must send clear signals to innovators that it doesn't pick winners. To achieve flexibility goals, government must be technology-agnostic.

"A real-time and near term flexibility market could be achieved through the expansion of the national balancing mechanism, where the bulk of grid balancing is conducted. Today, demand side and storage aggregators are completely excluded from participating in this market, where the bulk of grid balancing is conducted – valued at £800 million per year. Expanding market access to allow for demand side response can trigger the unlocking of significant capacity."

ⁱ www.ashden.org/files/case_studies/Open%20Energi%20Ashden%20UK%202016%20case%20study.pdf

ⁱⁱ www.openenergi.com/londons-spare-gigawatt-of-power

Real benefits for London

As London's most heavily used infrastructure, the city's homes and workplaces are capable of producing broad and deep benefits when their energy efficiency is improved.

Well maintained homes and businesses

- Energy efficiency works are a vital part of maintaining our homes and business premises. Cold buildings often become damp which can lead to mould and further complications in the long run. Insulated wall cladding will tackle damp permanently and can rejuvenate the appearance of a home or building.

Keeping money in the local economy

- Londoners spent on average £530 per year on household electricity bills and £645 on their gas bills – £1,175 in total. Across Greater London, that's £3.9 billion¹¹. Money spent on fuel is mostly taken out of the local economy, so cutting bills means that households have more money to spend in London's shops and businesses.

Creating skilled jobs

- Economic modelling has shown that an ambitious UK energy efficiency programme would support 10,300 jobs in Greater London²⁹. Energy efficiency works rely on skilled tradespeople and small-scale contractors. This means that these jobs are spread across all communities and not just concentrated in a few areas.

Improving health and wellbeing

- Cold homes have been shown to be damaging to both physical and mental health. Children living in cold homes are significantly more likely to suffer from respiratory problems such as asthma and bronchitis. It has been shown that for every £1 invested in renovating cold homes, the NHS saves 42 pence in reduced hospital admissions and GP visits³⁰. Ill-health also has an impact on our economy: London lost 14 million work days to ill health in 2012/13³¹. Minor illnesses and respiratory conditions which can be exacerbated by poor work and home environments make up a significant number of these.

Business productivity

- Energy costs can be a significant overhead for businesses. Improving the efficiency of commercial buildings, vehicles and equipment can cut waste and add to the bottom line. Helping businesses to identify these opportunities can boost productivity and make local businesses more competitive. In the retail sector, cutting energy costs by 20% can have the same impact on the bottom line as a 5% increase in sales³². Crucially, thermal comfort in the work environment is now well-established as a real boon to workers' health, wellbeing and productivity³³.

Improving local energy resilience

- It is easy to take basic services like gas and electricity for granted, but our energy security has become a significant concern in recent years. A more efficient housing stock and local generation will make London more resilient to future energy price shocks or interruptions to supply and can take the strain off local energy infrastructure.

The challenge London set itself in its 2011 Climate Change and Energy Strategy is ambitious. To reduce the city's CO₂ emissions, the target for buildings is to (a) retrofit 2.9 million homes (out of a current 3.35 million); (b) retrofit public buildings comprising a total of 11 million m² of floor space; and (c) retrofit 44 million m² worth of private sector workplaces by 2025. These 55 million m² constitute two thirds of London's non-domestic stock of buildings. Currently, London is falling well behind on its milestones to 2025¹³.

A step-change in energy efficiency delivery is needed, combined with a panoramic view and thorough understanding of all the benefits it can bring. Capturing the above benefits simultaneously, by investing in the energy performance of our buildings, will help London to meet its targets, maintain its economic competitiveness and to be a place that people want – and can afford – to live and work.

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www.instagroup.co.uk
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www.openenergi.com/ashden-awards-2016-open-energi-case-study-2
- Matt Wicks, Marketing Coordinator, Sir George Monoux Sixth Form College
www.sgmc.ac.uk/aboutUs/awards.asp
- Mike Darby, CEO and Co-Founder, Demand Logic
www.demandlogic.co.uk
- Russell Smith, Managing Director, Parity Projects
www.parityprojects.com
- Sadhbh Ní Hógáin, Housing Retrofit Project Manager, Haringey Council
www.haringey.gov.uk/environment-and-waste/going-green/green-home-improvements
- Syed Ahmed, Director, Energy for London
www.energyforlondon.org
- Chris Large, Senior Partner, Global Action Plan
www.globalactionplan.org.uk

Notes

¹ 830,000 E, F or G-rated London homes; estimated using [English Housing Survey 2014-2015](#)

² 34% of Non-domestic EPCs issued in London achieved a rating of A, B or C. CLG (2016) [Live tables on Energy Performance of Buildings Certificates](#)

³ GLA (2011) [Delivering London's Energy Future—the Mayor's climate change mitigation and energy strategy](#)

⁴ Sadiq Khan & London Labour (2016) [A Manifesto for all Londoners](#)

⁵ GLA (2016) [Scenarios to 2050: London Energy Plan](#)

⁶ 7,000 large businesses, 208,000 SME and 761,000 sole traders. BIS (2015) [Business Population Estimates for the UK and Regions](#)

⁷ Total final energy consumption from domestic, commercial and industrial and transport. DECC (2015) [Sub-national total final energy consumption in the United Kingdom](#)

⁸ Whilst energy used by transport is important, it is not further covered in the report. Also note for example, that [approximately 1,000 GWh of electricity are used by London Underground for transportation](#). The way these statistics are compiled, this is not accounted for in the 'Transport' circle, but forms part of the electricity slice of the 'Public, Commercial & Industrial circle.

⁹ DECC (2015) Sub-national [gas](#) and [electricity](#) consumption data

¹⁰ Domestic floor space estimated based on a representative sample of 1,604 London homes surveyed in the CLG (2016) [English Housing Survey 2014-2015](#) Non-domestic floor space estimate based on Valuation Office Agency (2012) [Business Floor space statistics](#). Additional allowance for health, education, Pubs and Restaurants based on typical building sizes identified by DECC (2014) [Non-Domestic National Energy Efficiency Data-Framework](#)

¹¹ DECC (2015) [Energy price statistics](#)

¹² Based on consumption data noted in ⁷ and fuel tariffs from DECC (2015) [regional fuel price data](#)

¹³ London Assembly Environment Committee (2015) [Cutting carbon in London: 2015 update](#)

¹⁴ Based on 1,604 assessments carried out in London as part of the English Housing Survey

¹⁵ DECC (2016) [Annual fuel poverty statistics report 2016](#)

¹⁶ DECC (2016) [2014 sub-regional fuel poverty data: low income high costs indicator](#)

¹⁷ Marmot Review Team (2011) [The Health Impacts of Cold Homes and Fuel Poverty](#)

¹⁸ Delivery of measures 2005-2012 derived from a sample of [6,427 homes in London](#). Delivery of measures after 2012 based on regional data from DECC (2015) [Green Deal, Energy Company Obligation \(ECO\) and Insulation Levels in Great Britain, detailed report: to June 2015](#)

¹⁹ More detail on the [GLA website](#)

²⁰ Number of applicants and claims provided by GLA on request

²¹ DECC (2016) [Sub-regional Feed-in Tariffs](#) and [Renewable Heat Incentive \(RHI\)](#) statistics

²² Based on consumption data noted in ⁷ and average DECC (2016) [Gas and electricity prices in the non-domestic sector](#)

²³ CLG (2016) [Live tables on Energy Performance of Buildings Certificates](#)

²⁴ Non-domestic floor space estimate based on Valuation Office Agency (VOA) (2012) [Business Floorspace \(Experimental Statistics\)](#)

²⁵ Based on 2003 CLG data [Age of Commercial and Industrial Stock](#) with an allowance for new stock built since 2003 based on VOA data

²⁶ [Ipsos Mori poll](#) of 12,000 people across 17 countries found UK office workers least satisfied with their office temperature

²⁷ More detail on the [GLA website](#)

²⁸ Using energy consumption from ⁷ and gross value added from ONS (2015) [Regional GVA NUTS3, 1997-2014, and Gross disposable household income \(GDHI\)](#)

²⁹ Verco & Cambridge Econometrics (2012) [Jobs, growth and warmer homes](#)

³⁰ Department of Health (2009) [On the state of public health: Annual report of the Chief Medical Officer 2009](#)

³¹ ONS (2014) [Sickness absence in the labour market: February 2014](#)

³² Carbon Trust's [Energy efficiency advice for retail businesses](#)

³³ For an overview of the current state of knowledge, see *The Guardian* (24 September 2014) [Office buildings are key to workers' health, wellbeing and productivity](#)