Energising Greater Manchester

How residents and businesses across Greater Manchester are benefiting from energy efficiency and local, low carbon energy supply

Association for the Conservation of Energy

ade

Contents

Key points

The Greater Manchester city region aims to develop a low carbon economy, increase energy security, reduce fuel poverty and increase the health and wellbeing of its residents. Local energy action will contribute to these aims and is central to the city region's climate change and low emissions strategies. The rewards of stepping up activity in this area make this an opportunity too good to miss.

Heating, cooling and powering Greater Manchester's homes and workplaces

- Greater Manchester's 1.2 million homes account for 34% of its CO_2 emissions, and every household spends on average £1,151 on gas and electricity bills every year – a total of £1.3 billion.
- Workplaces – 77,000 buildings – account for 38% of Greater Manchester's emissions, and companies pay a total of £1.3 billion each year in gas and electricity bills.
- More than a third of homes and non-domestic buildings that have been given an Energy Performance Certificate (EPC) since 2009 have the lowest energy ratings of E, F or G (on the A-G scale) and are therefore wasting a large proportion of their energy.
- 140,000 (12%) of Greater Manchester households are considered to be fuel poor. This means they cannot afford to keep their homes warm due to a combination of low incomes and high energy costs. To be warm, these customers would have to spend over £200 annually more than a household that is not in fuel poverty.
- There is 175 megawatts (MW) near-term demand side response potential from flexible demand in business and industry across Greater Manchester, helping ensure system security and saving consumers money.

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

- We estimate that more than 903,000 significant works have been undertaken to improve the energy performance of homes in Greater Manchester since 2005. Many local schemes have contributed, for example, the GMCA's Green Deal Communities Little Bill Programme supported 1,240 homes and included less widely deployed insulation technologies such as insulation for solid walled properties (see case study 1).
- Less is known about improvements made in workplaces. However, public buildings' Display Energy Certificate (DEC) ratings have been steadily improving since 2009, and the public sector across Greater Manchester has explored working in partnership with Salix Finance to continue to improve the energy efficiency of public buildings (see case study 5).

Local energy supply is a growing resource for the city region

- There are currently six major heat networks in Greater Manchester supplying heat to more than 3,000 homes, businesses and a variety of public sector buildings, including Manchester Town Hall extension and library, Manchester University and Manchester Metropolitan University. The networks save more than 5,000 tonnes of CO_2 per year.
- There is 37MW combined heat and power (CHP) capacity installed at businesses across Greater Manchester. Fuel efficient CHP plants using natural gas, oil and renewable fuel sources save around 21.3 gigawatt hours (GWh) of fuel and 9,000 tonnes of CO_2 emissions per year, compared to heat generated in individual gas boilers and electricity produced from a distant combined cycle gas turbine (CCGT) plant. This is the equivalent of the energy used to heat 1,770 homes or emissions from driving 22 million miles in a car.

- There is currently 140MW renewable electricity capacity installed across Greater Manchester, producing around 360GWh of electricity per year. This equates to approximately 3% of electricity consumed across the city region. In addition, there is currently 51.5MW installed non-domestic renewable heat capacity, which equates to approximately 1.4% of heat consumed in the non-domestic sector across the city region.

These improvements bring a wide range of benefits to Greater Manchester

- The £2.6 billion that Greater Manchester's homes and workplaces spend on energy bills every year does not all stay in the city region's economy. Improving efficiency and increasing localised generation means more will be invested in Greater Manchester's economy, as well as increasing energy productivity and competitiveness.
- Many of these improvements are delivered by Greater Manchester businesses. An ambitious national energy efficiency retrofit programme for homes, with Greater Manchester taking up its fair share, would support 9,800 jobs across the region, whilst investment in new CHP plants could support 90 jobs per MWe.
- Cold homes have been shown to damage both physical and mental health, and thermal comfort in the work environment is well-established as offering substantial health, well-being and productivity benefits. For every £1 invested in renovating cold homes, the NHS saves 42 pence in reduced hospital admissions and GP visits.

The Green Summit

Following his election as Mayor in 2017, Andy Burnham announced his ambition for Greater Manchester to be one of the leading green cities in Europe.

In March 2018, a landmark Green Summit was held, bringing together environmental experts, interest groups, partner agencies, academics and local people to accelerate Greater Manchester's green ambitions. A series of announcements were made at the Green Summit, including:

- An ambition to bring forward the date by which Greater Manchester aims to be carbon neutral by at least a decade, to 2040.
- Using the Tyndall Centre report on the impact of the Paris Agreement on Greater Manchester to take a science-based approach to evaluating carbon targets and trajectories.[1]
- The Greater Manchester Spatial Framework will consider a date by which all new homes built across Greater Manchester will be net zero carbon.
- Exploring the development of an energy company for Greater Manchester to enable investment in energy generation, storage and control technologies to generate revenue from 'grid balancing'.
- Creating a workstream led by Electricity North West to understand the opportunities to increase local energy generation from smart, renewable sources.
- Creating a workstream led by the UK Green Buildings Council to assess how Greater Manchester's existing building stock can be retrofitted, and the employment opportunities that could be generated as a result of this activity.

The Mayor has agreed to hold a second Green Summit in March 2019 which will culminate in the publication of a five year implementation plan. Online discussion groups will be formed in the lead up to this second summit to support the development of the implementation plan.

More local energy action will help Greater Manchester thrive

Local energy is already transforming Greater Manchester. From efficiency improvements which are cutting bills and carbon, to local generation improving revenue for local businesses and flexible energy demand keeping supplies secure. Individually these all have value and combined they can be the engine of a healthier, happier and more productive local economy.

More efficient businesses with new revenue streams are more competitive and better able to withstand economic shocks. Warm homes underpin wellbeing and deliver savings for local health services, and healthy local people are vital to those competitive businesses. Greater Manchester was at the heart of the last energy-driven transformation of the economy, and it is part of a newer, cleaner transformation today. Capturing more of these benefits is key to Greater Manchester remaining at the forefront of the energy transition, leading to a competitive local economy and thriving community where people can, and want to, live and work.

Introduction

Decentralised energy is energy based at or near the energy user. A decentralised energy system is user-led; it is local, efficient, affordable and low carbon, and it enables energy users to make the choices that work for them.

This report, written in partnership by the Association for the Conservation of Energy (ACE) and the Association for Decentralised Energy (ADE)[2], highlights the potential for decentralised energy to deliver benefits to Greater Manchester, including by improving energy performance across Greater Manchester's buildings and by expanding local energy generation.

For example:

- The Greater Manchester Combined Authority's (GMCA) Little Bill programme delivered energy efficiency retrofits to more than 1,200 homes across the city region, lowering energy bills and supporting improved comfort and health in homes (see case study 1).
- The ongoing refubishment of Manchester Town Hall and Central Library complex will combine the benefits of energy efficiency with reliable and low carbon energy from CHP to offer enhanced public services to Greater Manchester's residents.
- Cargill PLC, a food production facility, simultaneously generates electricity and heat onsite through a 25MW CHP plant (see case study 7).

More than a fifth of the city region's 1.2 million homes are very energy inefficient[3], failing to deliver health and comfort to inhabitants. And although more than a third of Greater Manchester's non-domestic buildings have an EPC rating of C or above[4], the energy waste from the remainder limits the competitiveness of Greater Manchester's businesses.

Local businesses and households are investing in decentralised energy solutions to improve their competitiveness and comfort and reduce emissions. Approximately 1.5% of Greater Manchester's energy consumption is met by local, efficient and low carbon generation, which cuts energy waste and avoids losses on the transmission network.

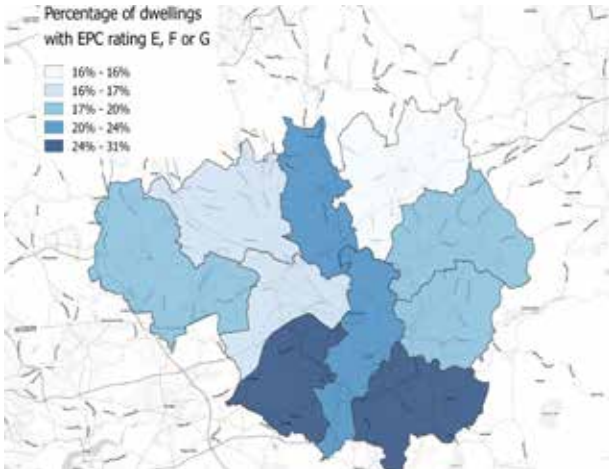

Figure 1: Percentage of domestic Energy Performance Certificates rated E, F or G, in each Greater Manchester Local Authority[5]

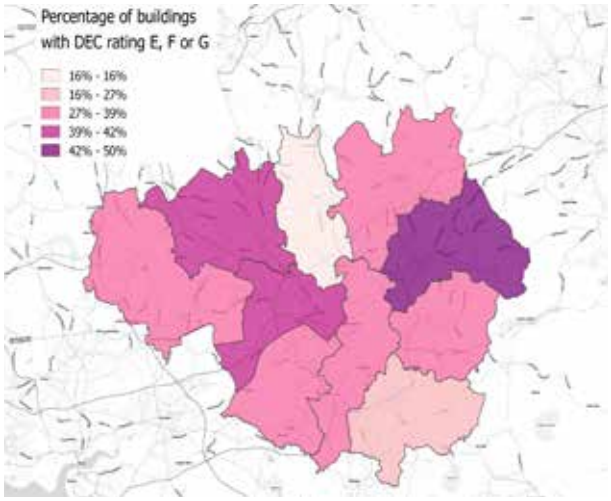

Figure 2: Percentage of public building Display Energy Certificates rated E, F or G, in each Greater Manchester Local Authority[6]

Energy has been a policy priority for the ten Greater Manchester local authorities for many years, with policies in place to tackle carbon emissions and fuel poverty. The development

of the GMCA, through the 2014 *Devolution Agreement* and further devolution agreements over the past few years, has enabled greater local control over areas such as health, transport and planning.

The Greater Manchester Strategy, 'Our People, Our Place'[7], details an overarching city region economic strategy which includes the aims of addressing fuel poverty, developing a low carbon economy, increasing energy security and improving the health and well-being of residents.

Greater Manchester's Climate Change Strategy[8] established a target to cut emissions by 48% between 1990 and 2020. In advance of national government commitments, Greater Manchester is also a signatory to three international commitments to reduce emissions by 90% by 2050.

At its 2018 Green Summit, the city region went further, aiming to be carbon neutral by 2040. Implementation plans for the new, more ambitious targets are yet to be developed but the existing plans already commit to significant local energy action.

The Climate Change and Low Emission Strategies' Whole Place Implementation Plan for Greater Manchester (2016-2020)[9] (the Plan) sets goals for reducing carbon emissions, improving air quality, promoting carbon literacy, transitioning Greater Manchester into a low carbon and low emissions economy, and adapting to a changing climate.

The Plan highlights there is no single intervention which will reduce emissions sufficiently and rather, a portfolio of action and choices across all aspects of society and business is required. The Plan notes the GMCA needs to prioritise decarbonising energy demand within homes, buildings and transport, and increase the amount of energy generated locally.

Analysis from the Tyndall Centre identifies that, from a 2013 baseline, 2.9 million tonnes of CO_2 savings will be delivered by 2020 if all of the existing and planned actions within the Plan are fully delivered. This includes a saving of 125.7 ktCO_2 of emissions resulting from energy efficiency activities.

The Plan committed the GMCA to establishing the necessary capacity and policy frameworks to accelerate the implementation of energy efficiency, generation, distribution, storage, trading and smart systems schemes across Greater Manchester. The Plan notes the combined efficiency and renewable generation action needs to reduce fossil fuel based energy consumption by 3-5 terawatt hours (TWh), and sets out a number of priorities, including:

- Establishing a clean energy masterplan and creating financial instruments, planning and policy frameworks to progress every opportunity for low carbon generation.
- Accelerating the delivery of a pipeline of low carbon energy generation projects, including heat networks and renewable energy.
- Deploying smart energy systems, including demand side flexibility and energy storage technologies.

Both the *Greater Manchester Strategy* and the *Climate Change and Low Emission Strategies' Whole Place Implementation Plan for Greater Manchester* recognise fuel poverty as a priority. In addition, the Greater Manchester Poverty Commission has identified food, fuel and finance as the three main causes of local poverty, and proposes greater local intervention to tackle the issue. Affordable warmth strategies and action plans to tackle fuel poverty have been produced by the ten Greater Manchester local authorities. The GMCA working with the councils, has an agreed Energy Company Obligation (ECO) flexible Statement of Intent (SOI).

Action on energy efficiency in Greater Manchester has been driven by a mixture of energy supplier obligations, a multitude of climate mitigation and fuel poverty alleviation initiatives from the ten Greater Manchester local authorities and GMCA programmes.

The challenge ahead

Despite the progress that these activities have delivered, the challenge remains significant. There is now a real opportunity for Greater Manchester's decentralised energy sectors to come together to drive the change needed. The experience gathered from the GMCA's programmes, and those run by the ten Greater Manchester local authorities, can be combined with the expertise and ideas of academic institutions, businesses and community groups, to develop a new energy system for Greater Manchester in which investment in energy demand management and decentralised energy plays its full role. If this happens, the city region can deliver the health, comfort, carbon reduction and productivity benefits that will support its continued status as a world class, low carbon city.

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Energy in Greater Manchester

Energy use

Greater Manchester is home to more than 2.7 million people and approximately 105,000 businesses. As a result, it consumes a great deal of energy.

In 2014, total final energy consumption stood at more than 50,000GW/h[10] – enough energy for an average electric car to circle the earth 25,000 times.

Greater Manchester's final energy use breaks down into 43% mains gas, mostly used to provide heat and hot water to homes and businesses, 23% electricity, and 34% road fuels and solid fuels used in industrial processes.

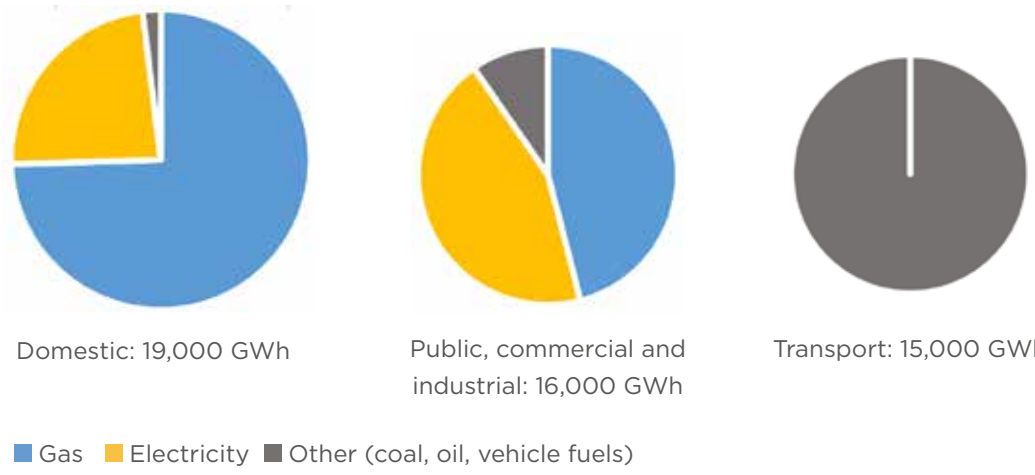


Figure 3: Greater Manchester's final gas and electricity demand by sector[10]

The largest energy demand across Greater Manchester is from homes, while the remaining demand is split fairly equally across public, commercial, industrial and transport sectors.

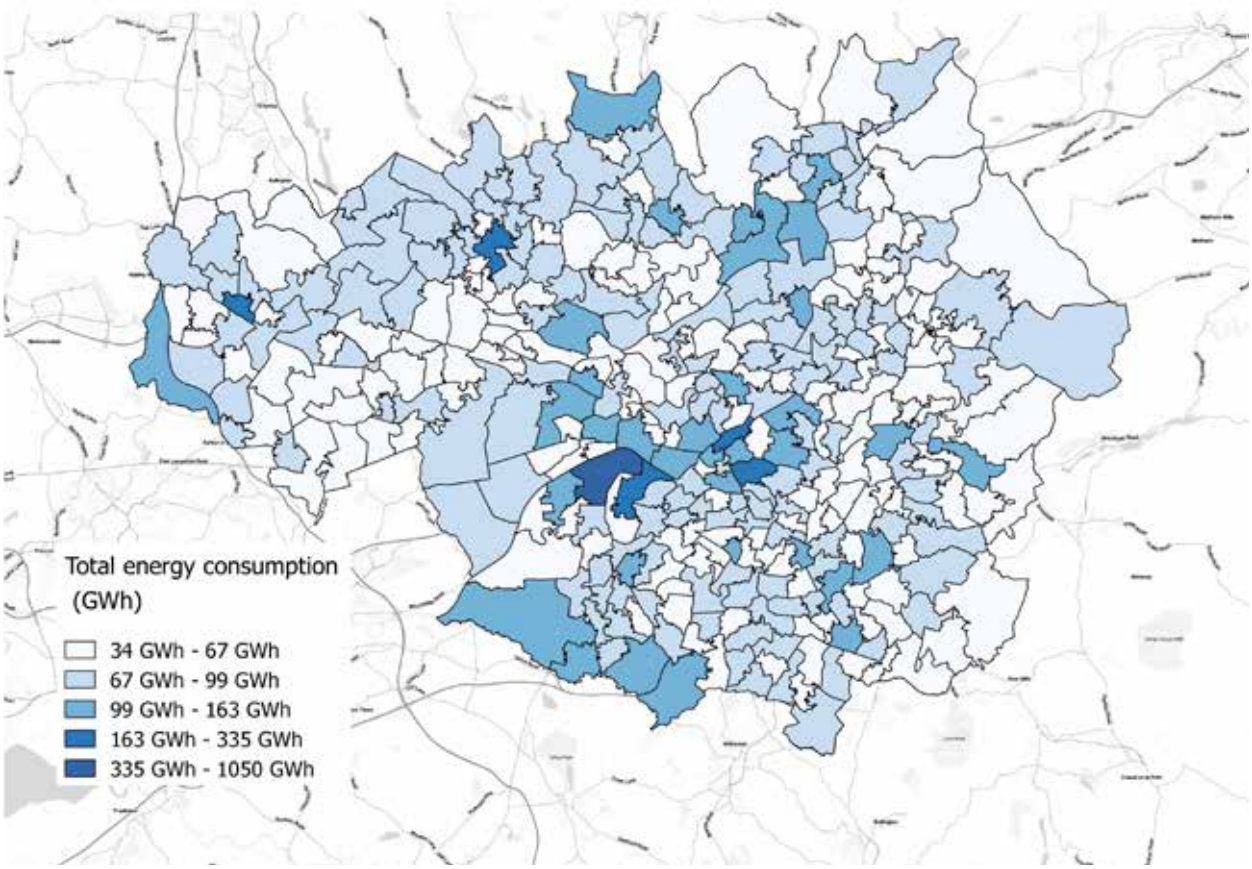


Figure 4: Greater Manchester's final gas and electricity demand in GWh by Middle Super Output Area[10]

Local energy generation

The GMCA is focusing its efforts to accelerate the delivery of low carbon energy generation projects. This includes finance support through the Greater Manchester Low Carbon Fund[11].

There is currently 140MW renewable electricity capacity installed across Greater Manchester, producing around 360GWh of electricity per year. This equates to approximately 3% of electricity consumed across the city region. In addition, there is currently 51.5MW installed non-domestic renewable heat capacity, the majority coming from approximately 136 installations of landfill, sewage and anaerobic digestion (AD) gas[12]. This equates to approximately 1.4% of heat consumed in the non-domestic sector across the city region[13].

There is 37MW CHP capacity installed at businesses across Greater Manchester, including 28MW at local food manufacturer Cargill (see case study 7). This equates to approximately 1.5% of Greater Manchester's total energy use. These fuel efficient CHP plants, using natural gas, oil and renewable fuel sources, save around 21.3GWh of fuel and 9,000 tonnes of CO_2 emissions per year, compared to the alternative of heat generated in individual gas boilers and electricity produced from a distant CCGT plant. This is the equivalent of the home energy use of 1,770 homes over one year or emissions from driving 22 million miles in a car[14].*

The Greater Manchester Waste Disposal Authority (GMWDA) has deployed anaerobic digestion and energy from waste plants, while Electricity North West has invested £270 million to transform the energy distribution system for balancing energy services and enable increasing energy storage capacity.

The next two sections of this report provide more detail on:

- **Managing energy use, focusing on the demand reduction opportunities to be found in both the residential sector and in non-domestic buildings, and in demand side response (DSR).**
- **Local and low carbon supply, showcasing how local solutions can help to lower carbon emissions, provide affordable energy and support security of supply for both homes and businesses.**

Managing energy use

Upgrading the energy performance of buildings

The buildings citizens in Greater Manchester live and work in 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 Greater Manchester an energy efficient, low carbon city region means tackling its diverse stock of buildings. A typical view of Greater Manchester'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 Greater Manchester'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 usage of business properties. Detailed data on the housing stock is regularly updated as part of the annual English Housing Survey.

The diagram below shows how Greater Manchester's stock of buildings is broken down between different uses[15]; houses and flats making up more than three quarters of the stock by floor area.

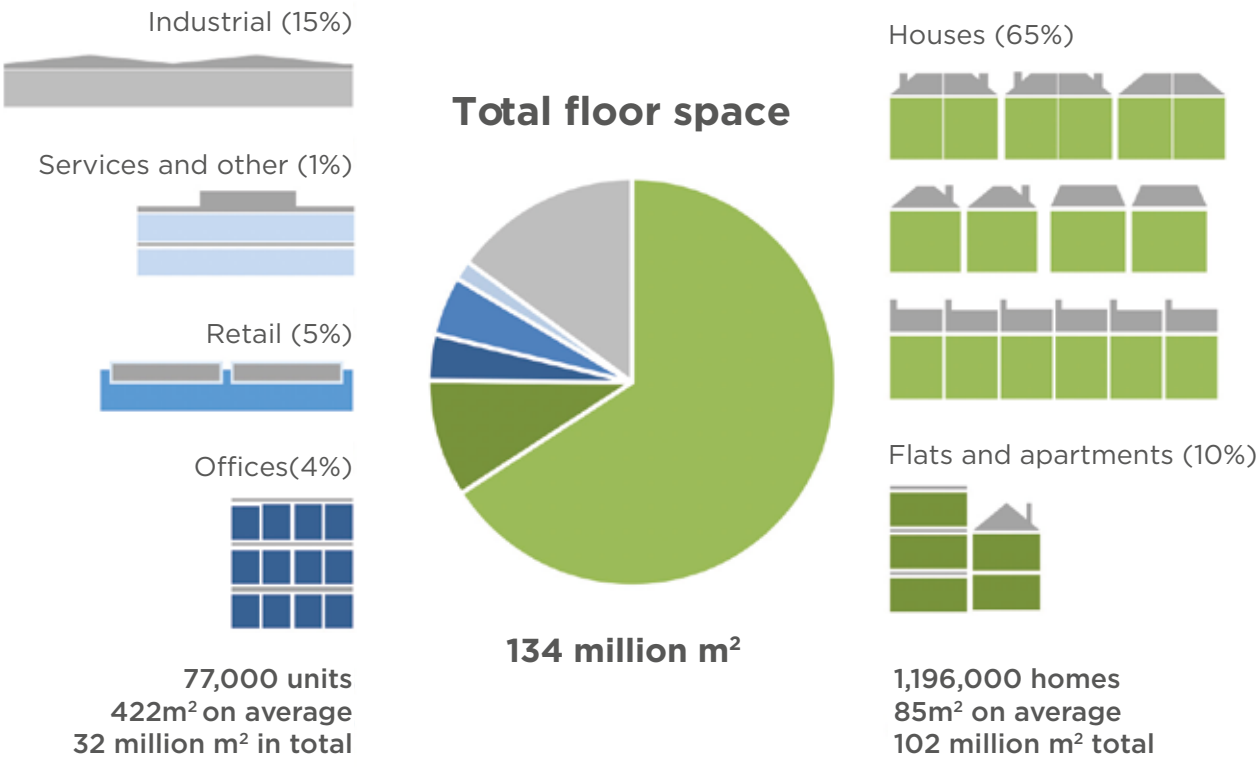


Figure 5: Breakdown of Greater Manchester's building floor-space by use[15]

Homes

Challenges

The price of gas and electricity to Greater Manchester households is 40% higher than it was ten years ago and compared to 20 years ago, prices have increased by two thirds[16]. Every year the residents of Greater Manchester spend £1.3 billion on their gas and electricity bills, with the annual average energy bill for households at £1,151[17]. The CO_2 emissions associated with this energy consumption make up more than 34% of Greater Manchester's total[18].

The majority of Greater Manchester'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. More than 20 per cent (260,000) of Greater Manchester's homes have the worst energy efficiency ratings of E, F or G (on the A to G EPC scale)[5].

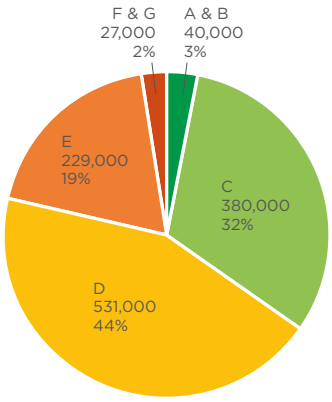


Figure 6: Energy performance rating of homes in Greater Manchester[5]

More than a quarter of Greater Manchester's homes have solid walls[19]. These homes are more challenging to insulate than those with cavity walls and the vast majority have no insulation at all. In addition, while Greater Manchester has in the past had a lower proportion of properties in the private rented sector compared to the national average (16.1%), the area is expecting to see significant growth within this tenure[20]. Unfortunately, landlords are less likely than owner occupiers to address the energy efficiency of their properties as their tenants pay the energy bills.

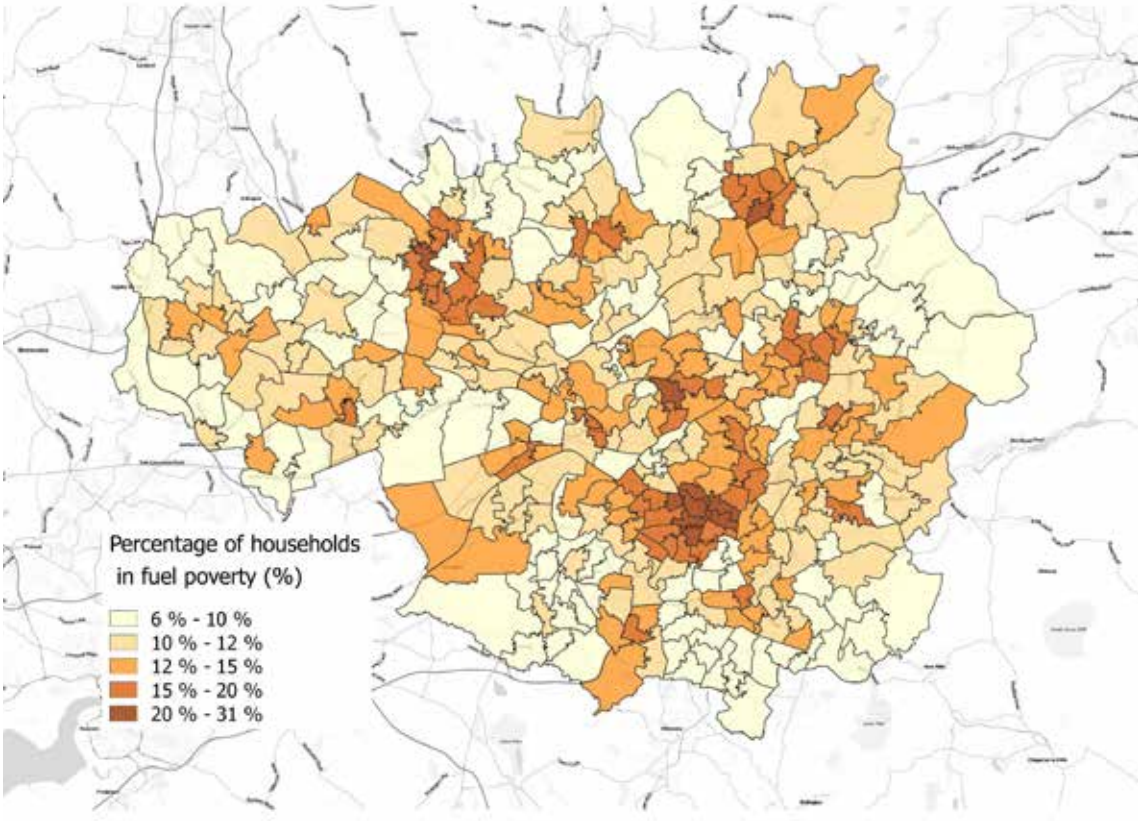


Figure 7: Manchester's incidence of fuel poverty by Lower Super Output Area

In 2015, 12% of Greater Manchester's households were fuel poor, more than the English average[21]. These 140,000 households represent 6% of all fuel poor households in England. In addition to being below the poverty line, each year, these residents would have to spend £233 more on their energy to keep warm than a household that is not in fuel poverty[22].

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 deaths[23].

The story so far

To combat high energy costs and inefficient housing stock, local authorities, community based organisations, businesses and delivery agents in the energy efficiency sector have been working hard to keep bills in check and Greater Manchester's homes comfortable.

Significant upgrades to the efficiency of homes have been made in recent years. We estimate that since 2005 approximately 903,000 significant works have been undertaken to improve the energy performance of homes in Greater Manchester[24].

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

Lofts insulated	325,000
Cavity walls insulated	271,000
Efficient boilers installed	307,000

Much of this work has taken place through national programmes – fuel poverty grants and energy supplier obligations – often complemented by local authority and GMCA schemes such as the Green Deal Communities Little Bill Programme (as featured in case study 1), which helped underpin energy efficiency improvements through advice provision and delivery support in 1,240 homes. This programme included less widely deployed insulation technologies such as insulation for solid walled properties.

Schemes in Greater Manchester, such as Warm Homes Oldham (see case study 2), have been set up to tackle the complex interrelated problems of poor housing and poor health.

National policies have played an important role at the local level. Ultimately, the dedication of the GMCA, local authorities, community based organisations, businesses and delivery agents, combined with national funding, support and incentive schemes, have been pivotal in the progress made so far across Greater Manchester.

Untapped potential

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

Detailed surveys of 1,825 homes in the North West of England 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 2: Number of homes in Greater Manchester that could benefit from basic energy efficiency measures[25]

Could improve the level of insulation in their lofts	209,000
Could benefit from cavity wall insulation	266,000
Could benefit from solid wall insulation	242,000
Could improve the efficiency of their heating systems	516,000

Greater Manchester outperforms most areas of the UK in terms of securing ECO funding; however, local practitioners have found that changes to such national energy efficiency schemes in the past few years have meant that funding for low income households is harder to secure and incentives for 'able to pay' households to undertake costlier upgrades are no longer available.

There are 800,000 homes in Manchester with an EPC of D or worse which 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 attention[5].

From April 2018, homes that are privately rented are subject to minimum energy efficiency standards and those with F and G ratings will have to improve.

Upgrading the energy efficiency of Greater Manchester's homes will 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.

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

Affordable Warmth in Greater Manchester

The GMCA is working with AgilityEco to deliver two projects designed to support households to reduce their energy bills and stay warm and well.

The award-winning LEAP (Local Energy Advice Programme) provides vulnerable and low-income households with free energy advice, income maximisation and a range of energy efficiency measures. More than 1,000 households across Greater Manchester have already received help and advice through LEAP, which is paid for by energy companies through their fuel poverty obligations. Electricity North West is also supporting the scheme by funding 500 LEAP referrals for its vulnerable customers.

The Warm Homes Fund (established by National Grid) provides funding for 'first time' central heating systems for households which only have expensive storage heaters, room heaters or open fires. Together, the GMCA and AgilityEco have secured enough funding for 500 households to receive a fully funded central heating system over the next 12 months.

Big Clean Switch

The GMCA launched a campaign in October 2017 encouraging residents to switch their energy supply to a competitive renewable energy tariff. A dedicated Greater Manchester Big Clean Switch website - **www.bigcleanswitch.org/gm** has been set up to help residents compare clean energy prices and switch. The scheme pilot saw households saving an average of £290.

Case study 1: Green Deal Communities Little Bill programme

In 2013, the Department of Energy and Climate Change (DECC) invited local authorities to apply to the Green Deal Communities fund, which aimed to maximise the delivery of Green Deal Plans across communities. Local authorities were encouraged to put forward 'ambitious and innovative' proposals to deliver Green Deal Plans to a large number of properties in target streets and areas.

The GMCA (known then as the Association of Greater Manchester Authorities - AGMA) submitted a successful combined bid to continue and build upon their energy efficiency retrofit activities and engage with fuel poor households in the private sector housing market (owner-occupied and privately rented homes) to make retrofitting an attractive product.

The 'Little Bill' scheme was valued at £8.8 million; including £6.1 million funding from Government to deliver the largest Green Deal Communities Programme in England. An additional £948,000 of funding was brought in by the Greater Manchester local authorities, £589,000 from ECO funding, whilst residents contributed an additional £1.2 million, many of whom accessed low cost finance through existing local authority loan schemes.

More than 1,240 households received measures, with more than 900 benefiting from retrofitted external wall insulation. Residents saved, on average, £350 per year on their energy bills, while the overall project saved an estimated 12,000 metric tons of carbon dioxide equivalent (tCO_2e).

The programme retrofitted an array of complex solid wall properties, including tinned wall, steel and timber framed properties, and park homes.

Activities in Greater Manchester's individual local authority areas include:

Manchester City Council: The Green Deal Communities scheme was delivered across Manchester City Council and included the retrofitting of external wall insulation to a number of BISF non-traditional houses. Such properties, which suffer from extremely low thermal comfort, were previously unable to obtain mortgages due to their non-traditional construction. However, the application of external wall insulation has changed this, and has brought an unexpected benefit to residents. The property value of these homes has increased on average by £15,000-£20,000.

Bolton Council: Seven streets of solid brick properties (former railway worker homes) in Horwich, Bolton had external wall insulation applied through an ECO scheme (phase 1: 100 properties) and the Green Deal Communities scheme (phase 2: 64 properties). EPC ratings for these properties increased from EPC bands E and F to bands D and C.

Stockport Council: A number of Park Home properties were transformed in Stockport with the retrofitting of both external wall and underfloor insulation. Occupants, many of whom were using bottled gas for heating their homes, have seen dramatic reductions in their energy bills.

Rochdale Borough Council: An area of Rochdale, which has seen flooding in recent years, was supported by the Green Deal Communities scheme to extract old cavity wall insulation and replace it with an innovative water-resistant insulation material. This will reduce damp problems should properties flood in the future.

The Green Deal Communities[26] [27] scheme was delivered by Greater Manchester's Green Deal and ECO Framework Partners, a collection of contractors including Keepmoat, Wates and Willmott Dixon and their sub-contractors. The GMCA was able to assist a number of local subcontractors, supporting them to prevent them from entering into administration, and maintaining the Greater Manchester city region's low carbon supply chain industry.

The project delivered a holistic approach to wider housing issues and coordinated other services for resident such as additional home repair works (e.g. roof repairs, security and safety advice through fire and police visits, street clean ups).

The scheme received very positive feedback from residents who value improvements in the thermal comfort of their properties, better understanding of their energy use and aesthetically pleasing improvements to their homes and wider streetscape.

The GMCA was awarded the Large Scale Project of the Year Award at the 2016 National Energy Efficiency and Retrofit Awards.

Case study 2: Warm Homes Oldham

The Warm Homes Oldham[28] scheme offers comprehensive advice and support to local Oldham residents who are struggling to pay their energy bills and heat their homes.

The pioneering and award-winning scheme was launched in 2012 by Oldham Council, NHS Oldham Clinical Commissioning Group (CCG) and Oldham Housing Investment Partnership (OHIP).

A study by the Centre for Regional Economic and Social Research at Sheffield Hallam University[29], reviewed the benefits to health and wellbeing by analysing data from households supported through the scheme in its first year of operation. The study found that investment in energy efficiency has led to significant improvements in general health and wellbeing, life satisfaction, and the condition of homes:

- 75% of participants moved out of fuel poverty.
- 60% of respondents with a physical health problem felt that the initiative had a positive impact on their health.
- 80% of people reported that the project had a positive impact on their general health and wellbeing.
- Almost all those who self-reported as being at 'high risk' of mental illness on completion of the General Health Questionnaire moved to 'low risk' following the initiative.
- 96% of respondents agreed their home was easier to heat as a result of their involvement in the project and 84% agreed that they now spend less on their heating.

It is estimated the scheme resulted in a £45,000 annual saving for the NHS due to reduced GP and hospital visits, counselling and medication. The study also estimated a £215,000 increase in Gross Domestic Product (GDP) due to higher employment rates and reductions in sickness absence, and a £137,000 reduction in benefit claims.

The total investment in the scheme stands at over £1.5 million. This includes investment from Oldham Council, the CCG and OHIP, as well as funding secured via ECO, Green Deal Communities, trust funds and central government central heating grants.

Councillor Barbara Brownridge, Cabinet Member for Neighbourhoods and Co-operatives at Oldham Council, said: *"Warm Homes Oldham is a great example of how the council is working co-operatively with its partners to improve the lives of residents."*

Angela Broadhurst, manager of Warm Homes Oldham said: *"The Warm Homes Oldham scheme has helped thousands of people out of fuel poverty over the last few years. But there is still plenty of work to be done and many more residents to help."*

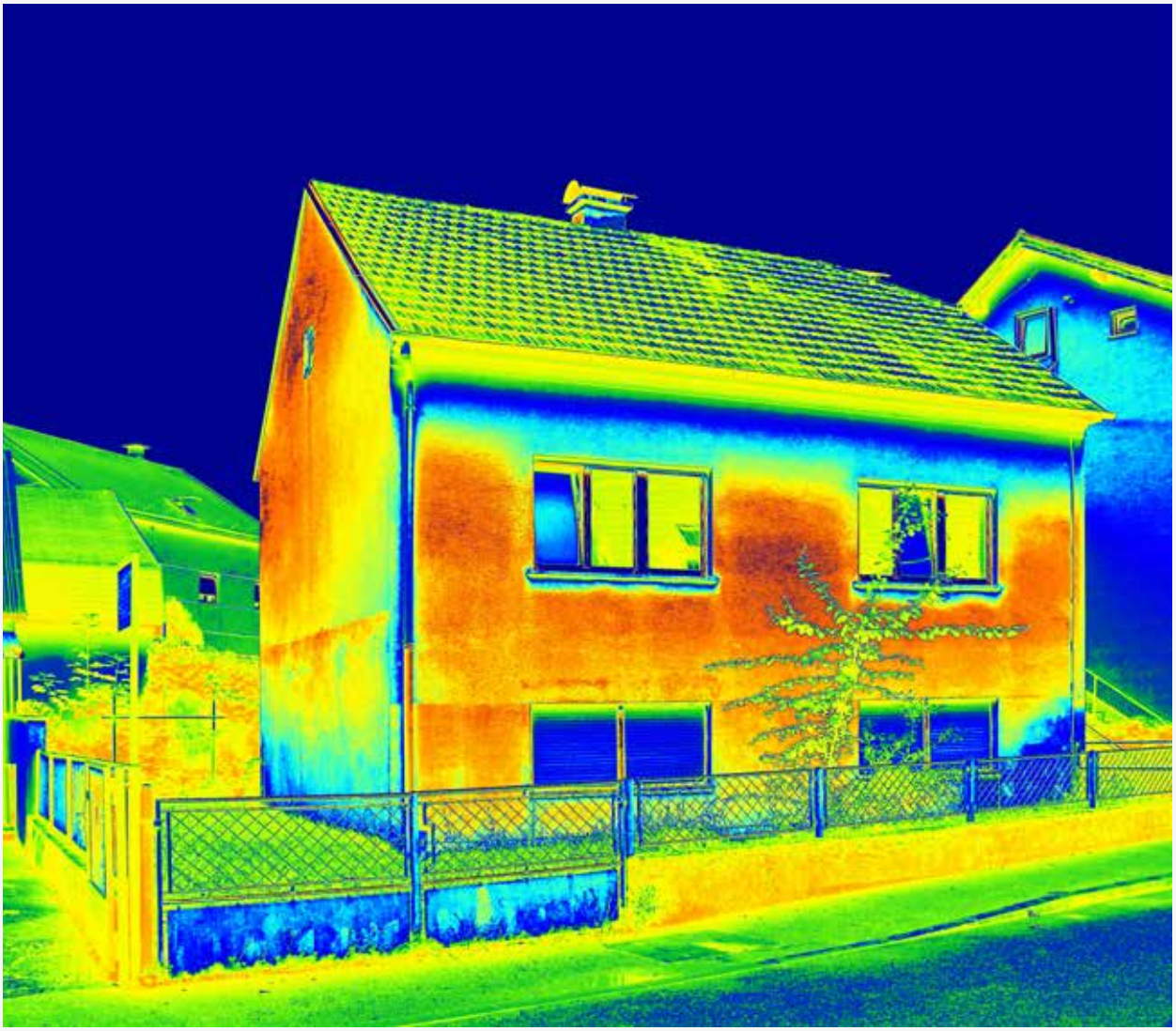
Case study 2: Warm Homes Oldham (continued)

A number of contractors have worked in partnership on this scheme, including Keepmoat Regeneration, Auriga Services, JNR Insulation Ltd and AgeUK Oldham.

Mark Drinkwater, Keepmoat Regeneration's Building Surveyor, highlighted that *"It's incredible to think the scheme has helped over 4,000 people out of fuel poverty in the last four years. At the height of the project, the partners employed around 30 people through its significant works programme, including staff in the call centre, mechanical surveyors, gas engineers, health and safety advisors, multi-skilled builders, building surveyors, customer liaison officers, a contracts manager and quantity surveyor."*

Mark also noted that in four years, almost 1,000 boilers and 50 central heating systems have been installed, and more than 300 solid wall properties have had insulation installed. Mark said he *"thoroughly enjoyed being a part of this pioneering programme, because every day you could witness the changes the scheme was making to peoples' lives in Oldham".*

Jamie Robson, Managing Director of JNR Contracting highlighted that around five jobs were sustained within his own organisation and that *"the scheme really goes one step further than any other scheme that JNR Contracting has worked on in terms of the in-depth identification of true fuel poverty. The scheme is fantastic at really investigating the core issues the residents of Oldham face and provides solutions!"*



Case study 3: Carbon Co-op and Energise Open Homes

Carbon Co-op was established in 2008 by a group of Greater Manchester residents to enable like-minded people to team up and make the exchange of home and building improvement ideas and experiences quicker and easier.

Carbon Co-op members take a 'whole house' holistic approach to the property, implementing packages of complementary improvements to give far greater efficiency savings - their target is to help members reach the performance levels necessary to meet 2050 carbon reduction targets.

As a co-operative the organisation is owned and run by the householders who make up its members. Anyone can join and by doing so gain access to technical advice, skills and resources as well as the opportunity to meet other householders working towards the same goals. In addition, members receive a discount on a household survey, a vital first step to understanding how much energy their building is using and which energy efficiency improvements will be most beneficial.

From 2013 to 2015, the Carbon Co-op ran the Community Green Deal home retrofit programme (linked to the Green Deal Communities Fund activity across Greater Manchester) in partnership with the design consultancy URBED. The project's aim was to see whether by offering 0% loan finance alongside mutual support and expert technical input, owner-occupiers could successfully self-finance a more ambitious level of energy retrofit than is typical of government programmes.

CarbonCo–op

Average works on this project cost £40,000 per house, which were paid for via 0% interest loans, householder contributions and ECO. The project results showed that, on average, energy use reduced by 50%, carbon emissions by 60% and energy bills by £800-£1,100. Encouragingly, the energy performance of homes taking part in the project increased to levels required to meet 2050 climate targets - nearly achieving the target of reducing emissions to 17kgCO_2/m^2, which represents the 80% emissions reduction from 1990 levels required to reach the 2050 emissions target.

The project also helped to raise awareness of climate change issues in the local community, engaged people and helped forge new relationships.

ENERGISE

Each year the Co-op runs the Energise weekend of events, an opportunity for communities to come together and for households across Greater Manchester to invite the public into their refurbished homes. During this weekend those participating are able to demonstrate the energy saving improvements made and discuss innovative ideas that may help others to cut their energy bills and carbon emissions.

Jonathan Atkinson, a Project Manager at Carbon Co-op said: *"One of our key success factors has been our collaboration with URBED that has enabled us to combine householder engagement and participation with high quality, cutting edge technical expertise. As we grow we are looking to take a whole energy system approach, combining energy services such as retrofit with grid aggregation and management. Going forward our challenge is to maintain a healthy balance between grant funded activity that benefits the whole community and income generating work that helps stabilise and underpin the organisation."*

Case study 4: Carbon Literacy Project

The Carbon Literacy Project[30] was launched in Manchester in 2012 with the aim of offering every individual in Greater Manchester a day of certified carbon literacy learning. This programme encompasses climate change science and ideas for action, and aims to promote large-scale behavioural change, leading to individual action on climate change becoming second nature.

The project foundations are built on the principle that when we are carbon literate we have an instinctive understanding of the carbon impact of our activities and are then able to choose the most energy and resource efficient and lowest carbon options. The project does not focus solely on the small steps that the individual can take to help mitigate climate change it also seeks to highlight the need for substantial change and aims to support individuals to have a 'cascade' approach to affect a much wider audience.

The project targets three audiences in Greater Manchester: those who live in the city, those who work there and those who study there. There are now an incredible 6,000 'Carbon Literate Citizens' and the numbers are rising by the day. In 2016 alone, the total number of certificates issued surpassed that of all certificates issued in the previous four years.

Repeated research shows the project is the only one of its kind operating in the world. The team is not limiting their activities just to Manchester; with carbon literacy workshops held in Edinburgh, Cardiff, Toulouse and Dublin to-date and ambition to hold more workshops further afield in the future.

In 2015, the Project was selected to be part of the prestigious Transformative Actions Program (TAP) as part of the UN Climate Change summit (COP21) in Paris.

Phil Korbel, Co-Director at Carbon Literacy Project said: *"We know what we have to do to tackle climate change – we just need to get everyone on board doing it. That's not simple – you need to have well designed learning programmes and support for Carbon Literate actions so that such action is not just for champions but the whole workplace or community. We'd like to see professionals involved in energy conservation using effective large scale behaviour change campaigns like ours as tools at their disposal to enhance the other measures that they are implementing. We're told that a workforce Carbon Literacy programme should save an employer some 5% on their bills – that could be all the difference in a low carbon investment case".*

The BBC is one major organisation to embrace the Carbon Literacy Project[31].

Businesses

Challenges

Businesses in Greater Manchester have felt the impact of rising electricity prices. For non-domestic consumers, the average price of electricity has increased approximately 60% in the past 10 years whilst gas prices have risen by more than 10%[32]. Every year Greater Manchester businesses spend £1.3 billion on their gas and electricity bills[33], affecting bottom lines and competitiveness. Many of the buildings are old and poorly insulated, with only 35% achieving an EPC rating of C or higher[34].

Buildings with poor energy performance are more expensive to run and make 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. A recent poll by Ipsos Mori found that 45% of UK office workers were dissatisfied with the room temperature at work[35].

Commercial and industrial buildings make up around a quarter of Greater Manchester's building space but consume half the energy. The stock comprises around 77,000 units with an average floor area of 422m^2. This includes 29,000 retail units (average floor area of 210m^2), 19,000 office units (average floor area of 260m^2) and 23,000 industrial units (average floor area of 840m^2). The remaining 6,000 are mostly school and university buildings, hospitals and healthcare, and a wide variety of buildings used for leisure such as cinemas[36]. At 38%, Greater Manchester's workplaces account for the largest share of the city region's CO_2 emissions[6].

The majority of commercial premises in North West England were built long before good insulation standards were required. By floor area, 37% of commercial buildings were built before 1940 and 86% were built before standards were improved in the early 1990s[37].

Older buildings with insufficient insulation can be expensive to run and difficult to maintain at a comfortable temperature in the winter or can overheat in the summer.

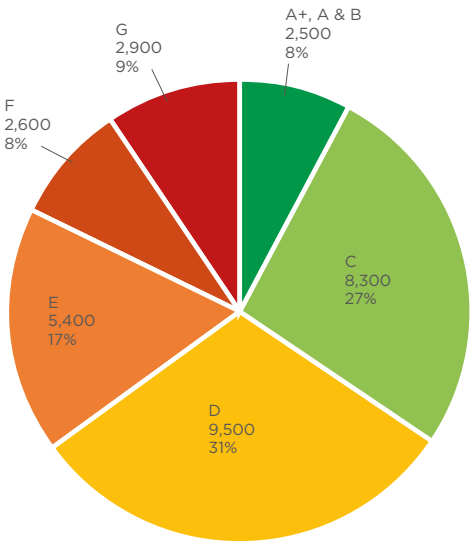


Figure 8: EPC ratings of non-domestic buildings in Greater Manchester[34]

Commercial and industrial buildings are required to have an EPC if they are sold or let to a new tenant. Since 2009, 31,000 EPCs have been lodged for non-domestic buildings in Greater Manchester. Of these certificates, two thirds recorded an efficiency rating of D or lower[34].

Public buildings such as schools and hospitals often 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 in workplaces. For these reasons larger public buildings are required to publicly report on their energy use with a DEC. In 2016, 2,057 of Greater Manchester's public buildings reported their energy consumption: only 7% received the highest ratings of A or B whilst 34% scored the lowest ratings of E, F or G[34].

The story so far

Larger public buildings in Greater Manchester are required to update their 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 has shown a steady reduction in the number of poorly performing buildings across Greater Manchester. In 2009, the year after DECs were first introduced, 25% of buildings scored an F or G, as shown in Figure 9.

Case study 5: Salix - working in partnership with the public sector

The public sector in Greater Manchester has a long-standing relationship with Salix Finance[38]. Salix provides 100% interest-free government funding to the public sector to improve energy efficiency, reduce carbon emissions and lower energy bills. Salix enables public sector organisations in the UK to take a lead in tackling climate change by improving the energy efficiency of their buildings and services.

One particular area of activity is in Greater Manchester's schools where funding of £328,760 has resulted in £773,264 savings annually and £1,096,543 over the lifetime of the projects.

On a larger scale, a number of Greater Manchester local authorities have worked with Salix to deliver investment in LED street lighting upgrades. Across the region, nearly £10 million has been invested, resulting in forecasted annual energy savings of £2 million and over £38 million over the lifetime of the projects. Great examples of this include Trafford Council and Wigan Council.

Trafford Council's £7.9 million street lighting programme, of which Salix is funding £6.3 million, will upgrade 24,000 street lights across the borough leading to the council halving its annual street lighting £1.2 million bill.

More than 32,000 street lights have been replaced as part of Wigan Council's street lighting programme, improving the overall efficiency and quality of street lighting across the borough. The programme cost was £10.5 million, with Salix funding £3.5 million. Energy consumption has been reduced by around 51% per year, saving over £716,000 annually as well as reducing greenhouse gas emissions by 2,900 tonnes.

Higher Education Institutes across Manchester have also improved the energy efficiency of their estate in partnership with Salix and the Higher Education Funding Council (HEFCE) since 2009. Manchester Metropolitan University, Salford University and University of Manchester[39] all have Salix/HEFCE Revolving Green Funds.

In total, the three Universities have invested over £9 million from Salix managed funding programmes into energy efficiency projects to help meet their 2020 carbon reduction targets. The annual cost savings generated from the funding programmes are over £2.8 million and are expected to reach over £36 million across the lifespan of the projects.

In the Greater Manchester region alone, the Salix/HEFCE Revolving Green Funds have enabled £7.1 million worth of energy efficiency projects to be carried out from an initial pot of £2.4 million. With repayments being fed back into the pot from energy savings, funds have been recycled 2.9 times since inception. All three universities have invested significantly in LED lighting projects as well as insulation, AHU replacements and a host of lab upgrades.

Within the NHS, Salix has worked with three Trusts across Greater Manchester, funding over £3.6 million of projects. Wrightington, Wigan and Leigh NHS Trust have utilised £2.6 million of Salix funding to implement multiple heat recovery and CHP projects, which combined are expected to save the Trust over £631,000 per year. Looking to the future, Salix is looking to expand activities in the NHS, with opportunities to support NHS Trusts across Greater Manchester improve the energy efficiency of their estates.

By 2016, only 12% of buildings across Greater Manchester has EPC ratings of F or G. Across this same time-period, the number of A, B and C EPC rated buildings increased from 21% to 27%.

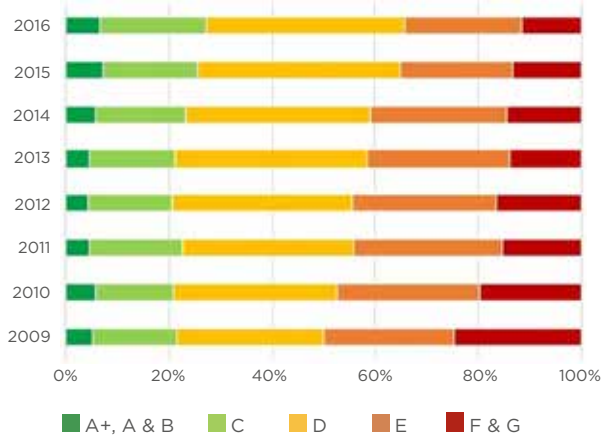


Figure 9: DEC ratings of public buildings in Greater Manchester[34]

Energy productivity, which is a measure of how much energy is needed to produce each unit of economic output, has been steadily improving in the UK, although there is still a lot of work to be done[40]. Better energy productivity strengthens businesses' competitiveness, helps boost overall productivity, improves energy security and can contribute to reducing the UK's carbon emissions.

Greater Manchester businesses can improve their energy productivity by improving the efficiency of their energy use or their energy supply. There is a real opportunity for the sector to drive an even more dramatic decoupling of energy consumption from economic growth.

50-50 Energy Efficiency Grant

The GC Business Growth Hub[41] has been providing funding to Small to Medium Enterprises (SMEs) in Greater Manchester to enable them to implement energy efficiency upgrades to lighting, heating, drives and motors. Expert advisers have also been on hand to help companies identify where they can make the biggest energy efficiency gains.

Untapped potential

Despite improvements to the energy efficiency of Greater Manchester's non-domestic buildings, there is still a vast opportunity remaining to make further savings. There are 20,500 buildings with EPC ratings of D or worse that would be likely to benefit from improvements to fabric and energy services. Of these, 5,500 buildings are rated F or G, meaning these buildings are very inefficient and likely to be wasting a large amount of energy. A significant number of these should be tackled as a result of mandatory minimum standards for the non-domestic private-rented sector. For Greater Manchester to be a low carbon city region, 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 energy consumption. Innovative approaches are required as well as more traditional fabric refurbishment.

The whole range of case studies featured in this report demonstrates that the know-how and ingenuity exists. With the right support, Greater Manchester is well placed to be a world leader in building energy refurbishment.

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Demand side response

Demand side response (DSR) is where energy users change their electricity consumption patterns in response to a signal or incentive to help balance the system. DSR can relate to reducing energy consumption or increasing on-site generation when the electricity system needs it.

Businesses able to be flexible in their energy use can take advantage of price fluctuations in the energy market and receive payments for their dynamic interactions with the grid. On the continent, where DSR is more prevalent, large consumers can reduce their annual energy bills by up to 10% by participating.

Challenges

Despite the growth in DSR, its market penetration still remains relatively low. The main barriers to growth identified by aggregators of DSR include regulation, market organisation and structural features of the market.

The story so far

With electricity demand expected to grow across Greater Manchester, and the increasing electrification of heat and transport, there will be more opportunities for the commercial and public sectors, as well as residents, in delivering DSR services.

Untapped potential

An estimated 2.8GW industrial and 1.7GW commercial 'turn down' DSR near-term potential exists across the UK, helping ensure system security and saving consumers money. Across Greater Manchester there is 175MW near-term DSR potential from flexible demand in business and industry[42].

The GMCA has committed to accelerating the delivery of low carbon energy generation projects and establishing a clean energy masterplan in order to progress low carbon generation opportunities. This will include providing flexibility to the network through DSR. Funding totalling £21 million has been secured from ERDF to support sustainable urban development in terms of smart energy innovation.

Greater Manchester Smart Community Demonstration Project

Greater Manchester has taken a leading role in understanding how householders can take part in DSR. Working with Japan's New Energy and Industrial Technology Development Organisation (NEDO), a £20 million, three-year Greater Manchester Smart Community Demonstration Project has installed electricity-driven heat pumps in 600 homes. By using smart controls and DSR, the project was able to switch heating off for short periods when the electricity system needed it without impacting householder comfort by relying on the high efficiency of their homes. In future, participating householders could be rewarded for providing this benefit to the electricity system[43]. The project has recently won the national CIBSE Award for best collaborative project[44].

Case study 6: Bridge 5 Mill: Centre for Sustainable Living

Bridge 5 Mill: Centre for Sustainable Living (formerly the Manchester Environmental Resource Centre Initiative (MERCi)) was established by a dedicated group of people in the 1996. The group had a vision for a centre in Manchester which could become a hub for organisations and individuals working on environmental and social issues in the area. It houses offices, a conference room, meeting rooms and an Exhibition Space.

When refurbishment of the Mill commenced there was a clear ethos in mind to carry out the refurbishment in the most environmentally friendly way possible and to ensure the Mill was as energy efficient as possible. Reclaimed, repurposed and recycled materials were used and several water saving measures and low energy fittings were added. No PVC products were used in the project.

In keeping with the aim to work with and create a hub for the community, apprentices from the local community helped with the refurbishment project, together with participants from the Building on Equality programme, (a green construction course for lone parent women). Many volunteers and professional craftspeople were involved in the project.

When Bridge 5 Mill opened it was one of Manchester's most sustainable buildings. Each floor now has its own boiler meaning temperatures can be regulated and energy is not wasted heating rooms not in use. A key aspect of the refurbishment was to maintain the industrial look of the building, so although walls were left largely untouched, the roof and in between floors were heavily insulated.

Now part of the Fairfield Environment Trust charity group, the organisation continues to build on its reputation as a hub and resource for local, national and international organisations working in the areas of the environment and sustainability. The building is managed on a day-to-day basis with sustainability in mind. For example, environmentally friendly, recycled, organic and Fair Trade products are used where possible. Bridge 5 Mill is also working towards becoming a zero waste building.

The building is home to several charities, campaign groups, social enterprises and a cooperative, all of whom share its values and aims. It provides a collaborative and supportive work environment for tenants. It also has conference and meeting rooms which it hires out on a sliding scale, with private and business hire rates helping to subsidise local campaign and community groups to use rooms at a price they can afford.

Michelle Lanaway, Manager of Bridge 5 Mill said: *"We always look at ways in which we can improve our energy efficiency and sustainability when we are doing maintenance and repairs to the building, which is over 150 years old. Since the building was refurbished technology has come a long way, we now have new, more energy efficient gas boilers, and we have recently fitted solar PV panels to our roof. These are more viable now than 15 years ago when we opened due to the shape and aspect of our roof. We are also constantly looking at our environmental impact on a day-to-day basis and try to ensure our purchasing choices and building management practices are as sustainable as possible. Our next step will be to look at conferences and meetings, to help and encourage organisers to make their events more sustainable."*

Efficient, local, low carbon supply

In the 19th Century, Greater Manchester led the way in the development of the UK's first gas and electricity networks. The city region has continued to build on its historical successes and is pushing ahead with the development of decentralised energy systems.

Working hand in hand with improvements to the energy efficiency of buildings, local energy generation solutions can help to lower carbon emissions, support security of supply, link local energy resources to need and deliver economic benefits through competitive pricing.

Industrial, commercial and public sector energy users are particularly well placed to invest in decentralised energy, both reducing carbon emissions and receiving revenue from energy markets.

CHP

CHP is the most efficient way to meet local heat and power needs when burning any fuel. By delivering both heat and power in one process, rather than in separate power stations and boilers, CHP improves the efficiency of the energy system by up to 30%. CHP can be used to generate hot water and heating for homes and businesses, as well as to generate steam on industrial estates.

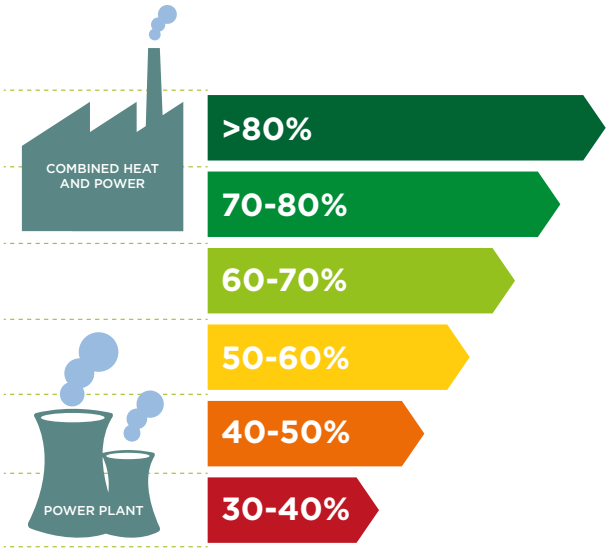

Figure 10: Generation efficiency[45]

Challenges

CHP is a mature technology with demonstrated benefits in terms of efficient use of scarce resources and emissions savings, but the market growth has flattened out since 2010 alongside the rise in natural gas prices. The industry identifies three key barriers to CHP investment, in particular in the larger-scale industrial sector: policy and regulation risk, policy and regulatory design and heat demand risk.

The story so far

There is 37MW CHP capacity installed at businesses across Greater Manchester, including 28MW at local food manufacturer Cargill (see case study 7).

The North West region is a hub for the CHP industry. ENER-G, a Centrica company based in Salford, has manufactured CHP systems since the 1980s, whilst the UK office for Edina, a CHP supplier and Queen's Award Winner, has been in Stockport since 1985.

Untapped potential

Energy users could choose to invest in CHP to help improve the efficiency of the energy system. Across the North West, CHP could cost-effectively provide 19TWh of heat per year[12], in addition to meeting substantial local electricity demand and supporting the creation of 90 jobs per MWe[46].

Case study 7: Cargill's industrial CHP

Cargill's production site in Manchester traces its roots back to 1911 and the first CHP plant was installed on-site in 1954, enabling the site to produce its own electricity and heat onsite.

The site produces in excess of 300,000 tonnes of glucose every year, in addition to bran, gluten and potable alcohol.

The company is committed to reducing greenhouse gas emissions, energy and water consumption. It has continually focused on driving down energy consumption through heat integration, the installation of new technologies and behavioural based energy management.

In total, the CHP installed produces in excess of 200GWh of electricity and half a million tonnes of steam each year. The CHP plant reduces the carbon footprint of the company by more than 10,000 tonnes every year.

Russ Comrie, Site Energy & Utilities Manager, Cargill PLC said: *"Cargill is committed to building a sustainable future. The efficient generation of energy is essential for us to continue reducing our impact and to allow our customers to thrive. Our CHP operation allows us to do that."*

Case study 8: trigeneration within MediaCityUK

MediaCityUK is a 200-acre mixed-use property development on the banks of the Manchester Ship Canal in Salford and Trafford, and is a joint venture between Peel Land and Property Group and Legal and General Capital. The development's principal tenants are media organisations and the University of Salford.

A bespoke energy management programme to reduce carbon emissions and improve the sustainability of its buildings has been developed by MediaCityUK. Since 2012, the annual savings from energy measures taken across MediaCityUK has exceeded £850,000.

A major investment at MediaCityUK is the combined cooling and heating (CCHP) scheme, a central, on-site energy source which supplies a low carbon form of electricity, heating and cooling to the development.

The design of the scheme takes advantage of the development's waterside setting by incorporating a novel cooling system. The system extracts and recycles canal water which is then used to heat the buildings in the winter months and provide cooling for the absorption chillers and CHP unit during the summer. Through this investment, MediaCityUK has avoided the production of 1,722-tonnes CO_2e.

MediaCityUK is the first development in the world to become a BREEAM approved sustainable community and achieved the highest environmental rating through the use of a highly efficient CCHP.

To further build on their carbon emission reduction activities, MediaCityUK has committed to the roll-out of a Carbon Literacy Project; a training initiative aimed at tackling the effects of climate change. Further information on the Carbon Literacy Project can be found within case study 4.

Building integrated renewables

The integration of renewable energy technologies can complement energy efficiency improvements in both new and existing buildings, helping to further reduce energy costs at a building level. Technologies include solar photovoltaics (PV), solar thermal, biomass boilers and air, ground and water source heat pumps.

Challenges

There are however a number of challenges that need to be resolved:

- Heat supplied to buildings will need to be decarbonised while controlling costs.
- Heat pumps have a technical potential to provide up to 8GW of heat in Greater Manchester, which would potentially increase peak electricity demand by 2-3GW, placing increased strains on local electricity networks.

The story so far

In total, 140MW renewable energy capacity is installed across Greater Manchester, producing around 360GWh of electricity per year. This equates to approximately 3% of electricity consumed across the city region.

In addition, there is 51.5MW installed non-domestic renewable heat capacity; the majority of this capacity installed at approximately 136 landfill, sewage and AD gas sites[12]. This equates to approximately 1.4% of heat consumed in the non-domestic sector across the city region[47].

There has been a great deal of local supply activity since *Greater Manchester's Climate Change Strategy* was launched, including:

- The establishment of a Low Carbon Project Development Unit to implement efficient energy generation schemes using £2.7 million of ELENA development funding and up to £35 million ERDF funds.
- Greater Manchester has been selected as one of three areas to work with the Energy Systems Catapult on significant smart systems and heat demonstrators by 2020.
- £20 million has been secured to trial new heating technologies linked by smart technology in 550 social homes.
- The deployment of more than 28,000 PV cells, some through `rent a roof' schemes.
- The development of hydro-generation in Oldham, Rochdale and Stockport.
- The development of heat generation schemes including high rise biomass heating in Stockport, and air source heat pump projects across Bury, Manchester, and Wigan.

Untapped potential

The GMCA has committed to accelerating the delivery of low carbon energy generation projects and establishing a clean energy masterplan in order to progress low carbon generation opportunities. This will include investment in battery storage, renewable power and/or heat.

Greater Manchester has technical potential to meet approximately 9% of its electricity demand using local renewable power production, and 68% of heat demand from renewable energy[12].

Residents and businesses, working in partnership with the GMCA and local government, can support this activity to create a more productive, competitive, cost effective, resilient and lower carbon energy economy in Greater Manchester.

Low Carbon Fund

In March 2018, the GMCA launched the £15 million Low Carbon Fund (the Fund)[48] to promote the production and distribution of renewable energy resources in the region. The Fund, established as part of England's 2014-20 ERDF Operational Programme, will support renewable and low carbon technology installations, including heat networks. Aimed at property developers and infrastructure providers, the Fund will support projects that would not attract traditional commercial finance.

Greater Manchester Community Renewables Limited

Greater Manchester Community Renewables Limited (GMCR)[49] is a community benefit society, set up and run by volunteers to install community-owned renewable energy across Greater Manchester.

GMCR raises funds through a community share issue, to install PV panels on schools and community buildings, helping to reduce bills and carbon emissions, and inspire children and the community to learn about energy and climate change.

In 2016, GMCR installed PV panels on three schools in Salford and a community centre in Partington. In 2018 funds are being raised to finance PV on an additional four primary schools in Salford.

Case study 9: Parr's Wood High School

In 2011, Parrs Wood High school embarked on a detailed programme to create long-term energy savings and recycling improvements. This programme was led by the school's CO_2 team, with the involvement of the whole school community. Their success has been outstanding and led to a visit in December 2015 by the then Secretary of State for Energy and Climate Change, Ed Davey MP. The school also received an award from the Speaker of the House of Commons, John Bercow, for the set up and promotion of recycling within the school, which is now running at a staggering 97%.

In 2015, the school began a PV project: there are now nearly 1,000 PV panels on the school's roof which generate more than 200,000 kilowatt hours (kWh) energy a year. Funding came from a low carbon grant programme from Manchester City Council. Aside from the benefit of reducing the school's carbon footprint, this solar array is now a key teaching aid in lessons and is also helping to nurture important business skills. For each project undertaken, the students have used a variety of ways to calculate projected savings and payback times; estimated at approximately 12 years for the PV.

A Salix loan was used to fund a comprehensive upgrade to the lighting and building energy management system. This lighting upgrade combined with the installation of modern building energy management systems reduced energy costs by 13%. There have also been improvements to insulation and glazing throughout the school.

In January 2016, the CO_2 team held an Efficiency and Recycling Convention to which other schools were invited. This enabled Parrs Wood School to share their experiences and disseminate information to other schools hoping to follow their example. Their fantastic success has meant that Parrs Wood High School is now used as a flagship example to other schools across Manchester.

The Parrs Wood School project was part of *Manchester: A Certain Future*, the city's climate action plan, which aims to reduce carbon emissions in Manchester by 41% by 2020.

Chris Baker, from Parrs Wood School said: "*The Parrs Wood Solar PV initiative was something that both Parrs Wood's student 'CO_2 Energy efficiency team' and the Council had been looking into for some time. The student CO_2 team members had already looked at a number of funding options to utilise the roof space for solar PV and calculated likely pay back times. The plan proposed by the council had several advantages including good financial returns for the school, with minimum financial risk. The council involved our student representatives in the planning meetings so that the project was also a highly educational experience.*"

Heat networks

Heat networks comprise a network of insulated pipes used to deliver heat in the form of hot water or steam, from a central point to end users in two or more buildings. Heat networks are an attractive and cost-effective solution in areas of dense population where heat demand is concentrated into a relatively small geographical area.

A key advantage of heat networks is the ability of networks to connect sources of waste heat to points of heat use, thus improving the energy efficiency of the local economy. Waste heat can come from environmental sources such as rivers, from data centres and industrial estates, or from power generation through combined heat and power.

Heat networks can also use renewable energy sources, such as heat pumps and biomass fuels.

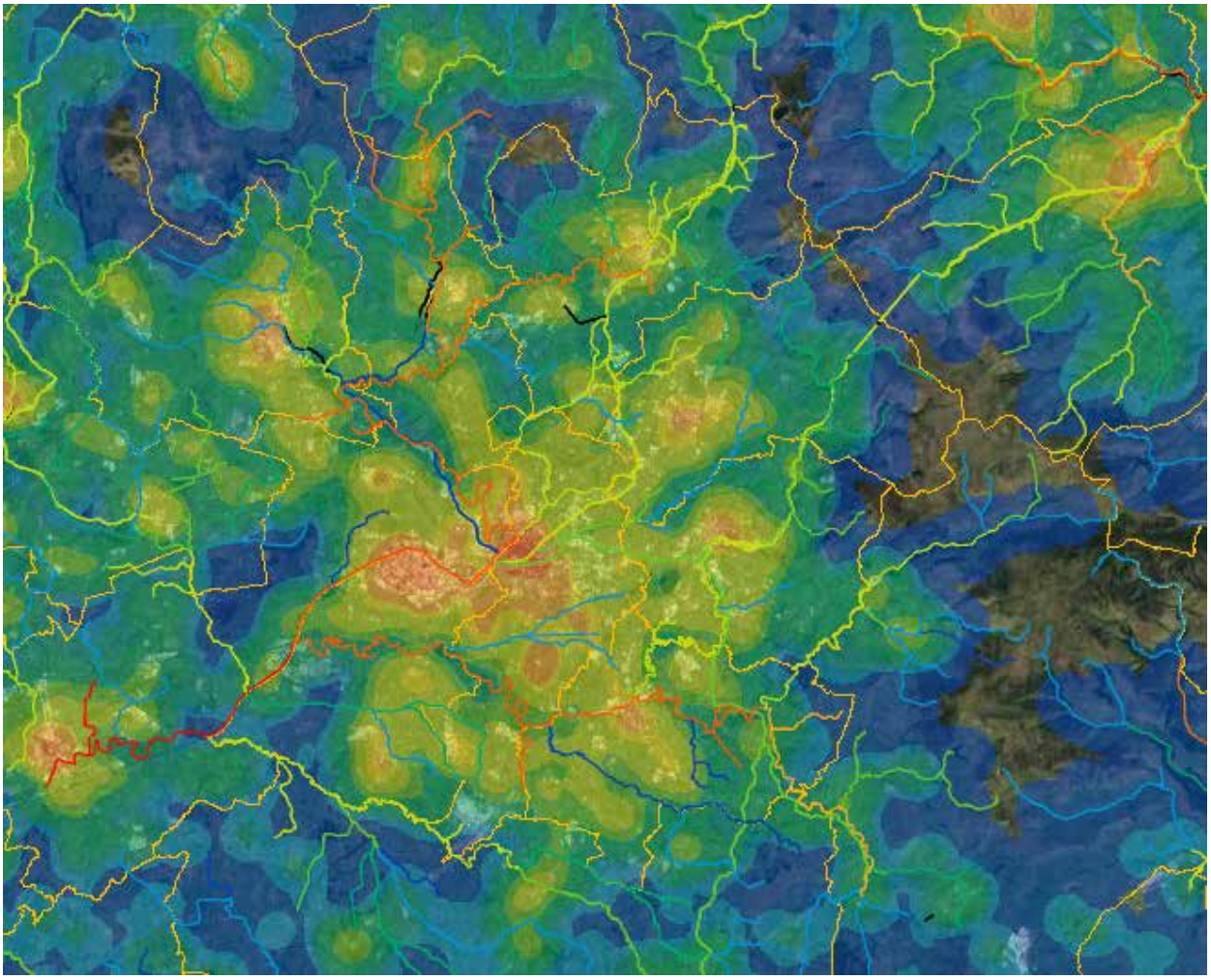

Figure 11: The National Heat Map[50] highlights 'local resource indicators' – in this case the heat available from Greater Manchester rivers and canals. This map is no longer available.

Challenges

There are a number of challenges which need to be resolved in order to tap into the potential of low carbon heat networks:

- There is a lack of internal resource and skills.
- There is a lack of cost-effective and supportive procurement options.

The story so far

There has been a great deal of local supply activity since *Greater Manchester Climate Change Strategy* was launched, including:

- An investment pipeline of heat networks and generation projects has been identified.
- Approximately £600,000 in Heat Network Delivery Unit (HNDU) grant funding has been awarded across the ten Greater Manchester local authorities since 2013. Two of those schemes qualified in the Heat Network Investment Project Pilot.

Heat networks across Greater Manchester, both existing and planned, are expected to save around 11,000 tonnes CO_2 per year.

There are currently six major heat networks in the Greater Manchester area serving more than 3,000 homes, businesses and a variety of public sector buildings including Manchester Town Hall extension and library, Manchester University and Manchester Metropolitan University. The networks save more than 5,000 tonnes of CO_2 per year.

Three additional heat networks - Civic Quarter Heat Network (CQHN), Trafford City Gateway and Manchester St Johns - are now in advanced development or construction. These represent an additional saving of 5,790 tonnes of CO_2 per year.

Civic Quarter Heat Network

The Civic Quarter Heat Network (CQHN) in central Manchester will provide energy across a two kilometre network encompassing a number of iconic buildings including Manchester Town Hall and The Bridgewater Hall.

The scheme will also include private wire electricity supply and potential for significant expansion to other heat off-takers.

The 'Tower of Light' is a 37 metre tall sculptural chimney that will be built as part of the plant. Commissioned for Manchester City Centre, structural engineers at Arup have been working in close collaboration with Tonkin Liu Architects on the design of the chimney, which supports the five chimney flues within.

Untapped potential

The technical potential for heat networks across the North West region is estimated at 37,000 GWh/annum, with a cost-effective potential of 4,000GWh/annum under current market and regulatory arrangements.

Substantial heat network infrastructure, with access to low carbon sources (including waste heat renewables), will need to be built across the heat-dense areas in the city.

The GMCA has committed to accelerating the delivery of low carbon energy generation projects and establishing a clean energy masterplan in order to progress low carbon generation opportunities. Greater Manchester's current pipeline of 12 heat networks could deliver savings of 45,000 tonnes of CO_2 per year. An additional 35 individual heat networks have been identified as having technical potential to reduce Greater Manchester carbon emissions by a further 413 $ktCO_2$ per year. In addition, approximately 161,000, or 15%, of existing households are located within 500 metres of a potential heat network[12].

Once a heat network scheme is delivered, it can act as a catalyst and pathfinder for other schemes, and demonstrate tangible heat network benefits. The CQHN scheme is likely to be the first delivered operational local authority led scheme in Manchester; it is expected to start construction in 2018.

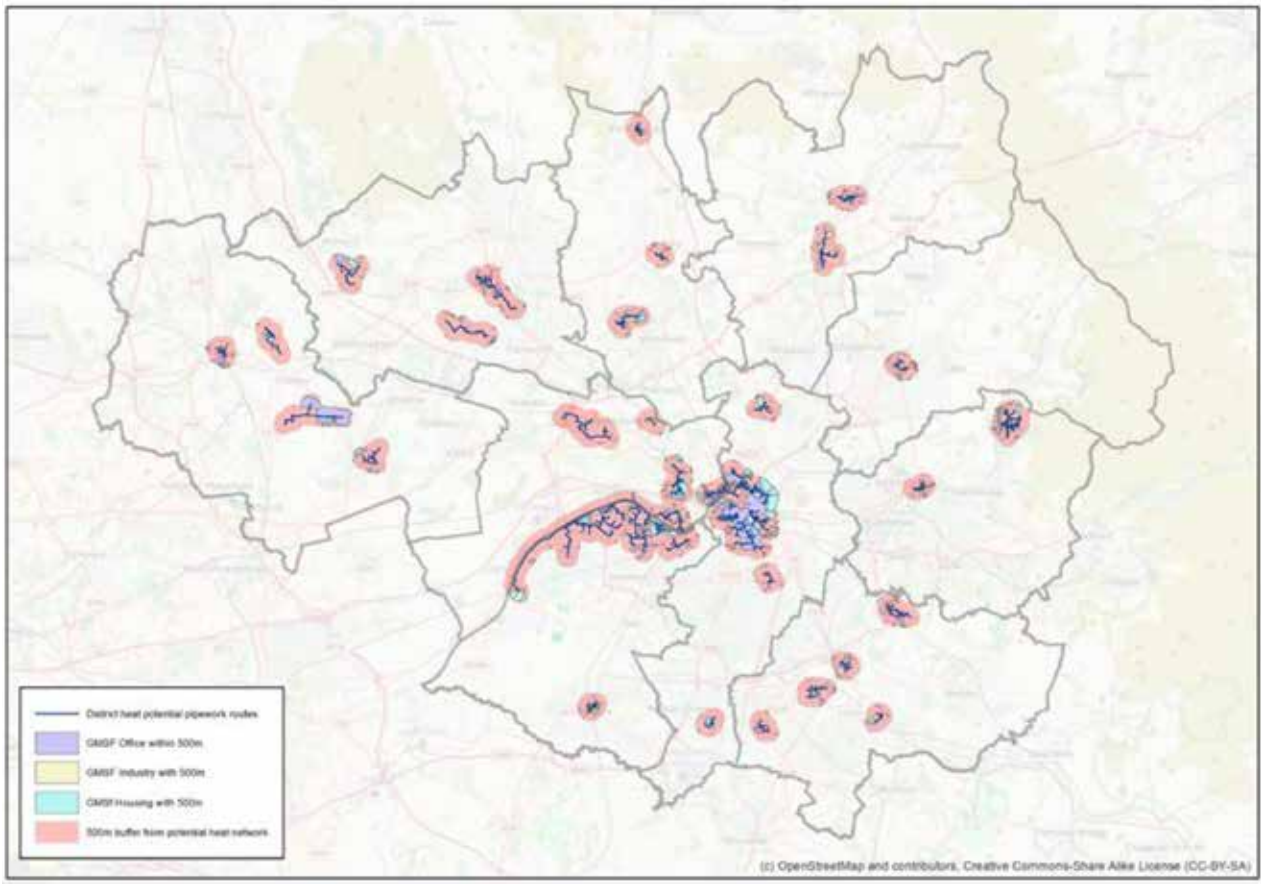

Figure 12: Greater Manchester Spatial Framework (GMSF) development areas within 500m of potential heat network[12].

Real benefits for Greater Manchester

As Greater Manchester'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 and the amount of energy generated locally increases.

Well maintained homes and businesses

Energy efficiency works are a vital part of maintaining our homes and businesses. 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

Greater Manchester residents spend on average £563 per year on household electricity bills and £557 on their gas bills – £1,120 in total. Across Greater Manchester, this totals £1.3 billion[17]. Money spent on fuel is mostly taken out of the local economy, so cutting bills through improving energy efficiency or generating energy through renewables means that households have more money to spend in local shops and businesses.

Creating skilled jobs

Economic modelling has shown that an ambitious UK energy efficiency programme for homes would support 9,800 jobs in the North West[51]. Energy efficiency works rely on skilled tradespeople and small-scale contractors. This means these jobs are spread across all communities and not concentrated in a few areas.

Investment in new CHP plants could support 90 jobs per MWe[46].

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 visits[52]. Ill-health also has an impact on our economy: North West England lost 15 million work days to ill health in 2012/13[53]. 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 increase profit margins. 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 sales[54]. Increased efficiency can also make it easier and cheaper to maintain a workplace at a comfortable temperature, and there is good evidence to show that this leads to increased worker productivity and hence financial benefits to employers[55]. Crucially, thermal comfort, good ventilation and lighting quality in the work environment is now well-established as having real benefits to workers' health, wellbeing and productivity[56].

Improving local energy resilience

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

The future

The challenge Greater Manchester set itself, to become carbon neutral by 2040, is ambitious. The city region is not yet on track to deliver on this ambition.

A step-change in energy efficiency and decentralised energy delivery is needed, combined with a thorough understanding of all the benefits it can bring. Capturing the above benefits simultaneously, by investing in the energy performance of its buildings and in local energy supply, will help Greater Manchester 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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Capturing the above benefits simultaneously, by investing in the energy performance of its buildings and in local energy supply, will help Greater Manchester 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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Endnotes

1 Quantifying the implications of the Paris Agreement for Greater Manchester, Tyndall Centre: www.mace.manchester.ac.uk/media/eps/schoolofmechanicalaerospaceandcivilengineering/research/centres/tyndall/pdf/Tyndall-Quantifying-Paris-for-Manchester-Report-FINAL-PUBLISHED.pdf

2 The Association for Decentralised Energy (ADE) and the Association for the Conservation of Energy (ACE) are merging, creating a unified voice for decentralised energy solutions across the industrial, commercial, public and domestic sectors. The merged association will be known as the Association for Decentralised Energy. Further information: www.ukace.org/wp-content/uploads/2017/11/ADE-and-ACE-to-merge-press-release.pdf

3 Number of households with EPC ratings of E, F and G are from DECC weighted LSOA-level household energy efficiency ratings data, 2015. Total number of dwelling is from the 2011 Census, supplemented by DCLG new build data from 2011 to 2017.

4 36.4% of non-domestic EPCs issued across Greater Manchester achieved a rating of A, B or C. CLG (2017): Table A: non-domestic Energy Performance Certificates by energy performance asset rating

5 2015 DECC weighted LSOA-level household energy efficiency ratings data

6 CLG (2017) Live tables on Energy Performance of Buildings Certificates, Table DEC1: Display Energy Certificates by local authority and energy performance operational rating.

7 Greater Manchester Strategy – Stronger Together: www.greatermanchester-ca.gov.uk/downloads/file/8/stronger_together_-_greater_manchester_strategy

8 Greater Manchester Climate Change Strategy (GMCCS): www.manchester.gov.uk/info/500002/council_policies_and_strategies/3833/climate_change/4

9 Climate Change and Low Emission Strategies' Whole Place Implementation Plan for Greater Manchester (2016-2010): www.greatermanchester-ca.gov.uk/download/downloads/id/221/change_and_low_emissions_implementation_plan_2016-2020.pdf

10 Total final energy consumption from domestic, commercial and industrial and transport. DECC (2016) Sub-national total final energy consumption in the United Kingdom

11 Greater Manchester Low Carbon Fund: www.greatermanchester-ca.gov.uk/info/20002/finance_and_investment/108/low_carbon_fund/1

12 Greater Manchester Spatial Energy Plan - Evidence Base Study, energy technologies institute (ETI): http://es.catapult.org.uk/wp-content/uploads/2017/08/Compressed_GMCA_Spatial_Energy_Plan_2016_11_07-LATEST-ilovepdf-compressed.pdf

13 Calculations using the RHI Deployment Data up to December 2017 published by BEIS. Data available for the non-domestic RHI only on installed capacity. The load factor of all non-domestic installations in the UK is used as a proxy to work out the renewable heat generated from installations in the GMA.

14 Energy savings: Calculation based on the domestic typical gas consumption value (medium range) published by Ofgem (2017). Carbon savings: Source: Environmental Protection Agency U.S. Greenhouse Gas Equivalencies Calculator.

15 Numbers of each domestic dwelling type is from the 2011 Census, supplemented by DCLG new build data from 2011 to 2017. Typical floor areas are estimated based on a representative sample of 1,632 homes in urban areas of the North West of England, 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.

16 BEIS (2017) Domestic Energy Price Indices

17 Based on consumption data noted in [10] and fuel tariffs from BEIS (2017) regional fuel price data

18 The Greater Manchester Climate Change Strategy (2011 – 2020): http://media.ontheplatform.org.uk/sites/default/files/GM%20Climate%20Change%20Strategy.pdf

19 Solid wall and off gas network properties data: https://data.gov.uk/dataset/solid-wall-and-off-gas-network-properties-lsoa

20 Private rented sector in Greater Manchester, New Economy: www.neweconomymanchester.com/media/1438/private_rented_sector_in_greater_manchester_april_2015_-_v5-1.pdf

21 BEIS (2017) Sub-regional fuel poverty statistics 2015.

22 BEIS (2017) Annual fuel poverty statistics report, 2017 (2015 data)

23 Warm Front Health Impact Evaluation of the Warm Front Scheme https://www4.shu.ac.uk/research/cresr/sites/shu.ac.uk/files/warm-front-health-impact-eval.pdf

24 Delivery of measures 2005-2012 derived from a sample of 6,605 homes in the North West. Delivery of measures after 2012 based on regional data from DECC/BEIS (2015, 2016 and 2017); The latest ECO statistics are from Household Energy Efficiency National Statistics, headline release July 2017, Green Deal Home Improvement Fund data is from Household Energy Efficiency National Statistics, headline release July 2016 and Green Deal and Cashback data is from Green Deal, Energy Company Obligation (ECO) and Insulation Levels in Great Britain, detailed report: to June 2015.

25 The estimate for the number of homes that could benefit from basic energy efficiency measures in Greater Manchester is based on surveys of 1,825 homes across the North West of England. The data has been analysed to reflect the number of homes and different types of homes across Greater Manchester. Survey data part of the 2015 DCLG English Housing Survey.

26 http://gmlch.ontheplatform.org.uk/article/greater-manchesters-green-deal-communities-programme-2016-film-0

27 http://usir.salford.ac.uk/42064/1/Greatrer%20Manchester%20Green%20Deal%20Communties%20Programme%20Exit%202016%20%28final%29.pdf

28 www.oldham.gov.uk/warm_homes_oldham

29 www4.shu.ac.uk/research/cresr/sites/shu.ac.uk/files/warm-homes-oldham-evaluation-final-report.pdf

30 http://www.carbonliteracy.com/

31 https://vimeo.com/196593004

32 BEIS (2017) Gas and electricity prices in the non-domestic sector.

33 Based on consumption data noted in [10] and average BEIS (2017) Gas and electricity prices in the non-domestic sector

34 CLG (2017) Live tables on Energy Performance of Buildings Certificates, Table A: Non-domestic Energy Performance Certificates by energy performance asset rating.

35 UK Workers Least Satisfied With Their Office Environment https://www.steelcase.com/eu-en/press-releases/uk-workers-least-satisfied-with-their-office-environment/

36 Non-domestic floor space estimate based on Valuation Office Agency (VOA) (2012) Business Floorspace (Experimental Statistics).

37 Based on 2003 CLG data Age of Commercial and Industrial Stock with an allowance for new stock built since 2003 based on VOA data, https://www.gov.uk/government/statistical-data-sets/live-tables-on-commercial-and-industrial-floorspace-and-rateable-value-statistics

38 https://www.salixfinance.co.uk/

39 https://www.salixfinance.co.uk/system/files/documents/manchester_university_-_led_lighting_case_study.pdfhttps://www.salixfinance.co.uk/system/files/documents/manchester_university_-_led_lighting_case_study.pdf

40 The Association for Decentralised Energy (ADE), The 2016 UK Energy Productivity Audit: www.theade.co.uk/assets/docs/resources/2016_UK_Energy_Productivity_Audit.pdf

41 CG Business Growth Hub 50:5 Energy Efficiency Grant: www.businessgrowthhub.com/news/2018/04/50-50-energy-efficiency-grant

42 Based on proportion of total GWh of electricity demand from industrial and commercial customers in Greater Manchester, compared to total UK electricity demand (approximately 4%).

43 GM Smart Energy (2017): www.gmsmartenergy.co.uk/new-technology-home-heating-trails-proving-success-greater-manchester/

44 Prestigious award win for GM Smart Communities (NEDO): http://ontheplatform.org.uk/article/prestigious-award-win-gm-smart-communities-nedo

45 What is Combined Heat and Power, the Association for Decentralised Energy (ADE): www.theade.co.uk/resources/what-is-combined-heat-and-power

46 Figures based on the ADE publication Backing industrial productivity: the combined heat and power opportunity: www.theade.co.uk/resources/publications/backing-industrial-productivity-the-combined-heat-and-power-opportunity

47 Calculations using the RHI Deployment Data up to December 2017 published by BEIS. Data available for the non-domestic RHI only on installed capacity. The load factor of all non-domestic installations in the UK is used as a proxy to work out the renewable heat generated from installations in the GMA.

48 https://www.greatermanchester-ca.gov.uk/info/20002/finance_and_investment/108/low_carbon_fund/1

49 https://www.gmcr.org.uk/

50 National Heat Map: http://nationalheatmap.cse.org.uk/

51 Verco & Cambridge Econometrics (2012) Jobs, growth and warmer homes

52 Department of Health (2009) On the state of public health: Annual report of the Chief Medical Officer 2009

53 ONS (2014) Sickness absence in the labour market: February 2014

54 Carbon Trust's Energy efficiency advice for retail businesses

55 Lawrence Berkeley National Laboratory (LBNL) Indoor Environment Group. 2016. Cost Effectiveness of Improving Indoor Environments to Increase Productivity | Indoor Air Quality (IAQ) Scientific Findings Resource Bank (IAQ-SFRB).

56 World Green Building Council, 2016, Health, Wellbeing and Productivity in Offices: The Next Chapter for Green Building

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