



Climate Change and Low Emission Strategies' Whole Place Implementation Plan for Greater Manchester (2016-2020)

Our Headline Goals:



Cutting carbon emissions by 48%
between 1990 and 2020

Growing a Low Carbon Economy



Rapidly Adapting to a changing
climate

Embedding Low Carbon Behaviours



Achieving Air Quality Thresholds

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PLAN OVERVIEW:

The Key Elements of this Plan are:

- **OUR FIVE KEY GOALS:** (front cover) these provide the overarching focus for the Plan.
- **TEN CRITICAL ACTIONS:** these provide a strategic overview of **what needs to be done** to both achieve 2020 targets and lay strong foundations for our journey to a future low carbon economy.
- **PLAN AT A GLANCE OVERVIEW OF PRIORITIES:** looks thematically at **how the goals can be progressed**, and provides a framework for identifying priority interventions.
- **THE DELIVERY PLAN:** summarises the **specific actions and commitments**, many of which are already underway, to deliver our 5 key goals, and starts to quantify their carbon reduction impacts.
- **MEASURING AND MONITORING:** provides a summary of **existing performance**, and outlines the key information we will monitor in future.
- **SETTING FUTURE TARGETS:** sets out our **approach to establishing long and short term emissions trajectories**, setting targets and putting in place systems to estimate the impact of planned policy and project interventions.
- **WORKING TOGETHER:** outlines the governance, partnerships, accountable bodies and **stakeholder engagement** approach.

1 FOREWORD

This Implementation Plan is Greater Manchester's Whole Place Low Carbon Plan for the next 4 years. It builds upon existing work and sets out our priorities to 2020 and beyond. It includes actions to both address climate change and improve Greater Manchester's air quality. These have been developed in partnership with over 200 individuals and organisations as part of a wide ranging consultation.

Our objectives extend beyond achieving a challenging 48% carbon reduction target (by 2020) to preparing the city region to adapt to unavoidable climate change, promoting carbon literacy and transitioning Greater Manchester (GM) into a low carbon and low emissions economy with clean air and sustainable lifestyles. This can only happen by being at the forefront of innovative action locally and also relies on complimentary actions and investment at the national level. Greater Manchester is recognised as being an innovation leader with a number of smart, low carbon energy initiatives, built upon the long history of co-operation across GM's ten Districts.

A significant amount has been achieved since the publication of our Climate Change Strategy in 2012, a firm foundation has been laid, ready for us to accelerate our progress. Key achievements since our Strategy was launched in 2012 include:

- The delivery of over 10,000 retrofit measures in Greater Manchester's Housing Stock; including a £6.1m Green Deal Communities Programme; plus Salix funding to increase energy efficiency in GM's public buildings;
- Securing a £20m project to trial new heating technologies linked by smart technology in 550 social homes;
- Selected as one of three Local Authorities to work with Energy Systems Catapult on a significant smart systems and heat demonstrator by 2020;
- Establishing a Low Carbon Project Development Unit, to implement efficient energy generation schemes using £2.7m ELENA development funding and up to £35m ERDF funds;
- The deployment of almost 2,500 electric vehicles on Greater Manchester's roads and associated charging infrastructure;
- Major expansions to the Metrolink Tram network and £42m to fund the city region's cycling strategy; and
- Securing £1.2m for research and planning for climate change adaptation plus a proportion of a £14m Life Integrated Project to accelerate the delivery of water quality improvements over the next 10 years.

There is no single intervention which will reduce emissions sufficiently; it will require a portfolio of action and choices across all aspects of society and business. As the future is unpredictable, we have defined a flexible pathway to our target. However, we know that we need to prioritise decarbonising energy demand within our homes, buildings and transport. We also need to increase local energy generation. We estimate that up to 9% of existing electricity consumption could technically be provided by renewable energy sources. Up to 68% of existing gas demand could technically be replaced by renewable heat from heat pumps, solar thermal and bioenergy. District heating also has the technical potential to expand significantly in Greater Manchester.

Our targets are challenging and cannot be achieved by Local Authorities working in isolation. The Greater Manchester Low Carbon Hub aims to harness the knowledge of our universities with the innovation of our businesses under the strong public governance of the Greater Manchester Combined Authority. The Low Carbon Hub brings together a range of strategic partners from the private, public and third sector who recognise that, by working together, we are better able to cost effectively achieve our targets and provide the people of Greater Manchester with improved air quality, reliable low carbon energy and resilient, energy efficient places to live and work.



Paul Dennett, City Mayor of Salford and Chair of Greater Manchester Low Carbon Hub

**PAUL DENNETT, Chair
Greater Manchester Low Carbon Hub**

2 CONTEXT

Greater Manchester's previous Climate Change Implementation Plan (2012-2015) has been delivered against a backdrop of significant change. A new style of local government has brought together Greater Manchester's 10 local authorities to become the UK's first Combined Authority. A series of radical devolution deals have given greater local control over health, transport housing and planning. With more local control comes the enhanced ability to deliver positive air quality and low carbon impacts e.g. enhanced responsibility for local transport and a £300m housing investment fund to build 15,000 new properties over a 10 year period.

FACT: Nearly 11 percent (in 2013) of Greater Manchester households are in fuel poverty. The national average across England is 10.4%.

Greater Manchester has agreed to develop a Spatial Framework to guide investment for its long-term economic, housing and infrastructure development priorities. The National Planning Policy Framework states that the planning system is expected to make a significant contribution to tackling climate change. Vital roles include promoting energy demand reduction in buildings, greater opportunities for local renewable energy generation, linking future homes to employment with green transport and addressing the impact of increasingly volatile weather on people and systems.

Inefficient energy use and slow deployment of renewable heat/power adversely affects Greater Manchester's economy; damaging business productivity and personal prosperity, directly causing poverty. The rise from recession has been uneven, with rising employment contrasting with downward pressure on disposable income and an increase in zero hours and temporary employment. The Manchester Growth Company's organisations are progressing business support, inward investment, city promotion, trade and economic priorities. At the same time the GM Poverty Commission identified food, fuel and finance as the three main causes of local poverty, proposing greater local intervention.

From a low carbon perspective, whilst the commercial sector continues to decarbonise and access low carbon economic growth opportunities, decreasing subsidies and near-full penetration of simple loft and cavity insulation has led to a slowdown in the pace of domestic retrofit. Significant progress in public transport schemes and electrification of rail and car travel has been offset by increased demand for private car journeys. Successive national changes to financial incentives for low carbon generation and perceived public disaffection with the current energy system have led to a volatile low carbon generation and retail market, punctuated by big gains in offshore wind generation and an increasing desire for local and community energy solutions.

Poor air quality is having a real and significant effect on local people's lives, contributing to respiratory illnesses and cardio-vascular problems. In Greater Manchester alone, exposure to particulate air pollution (PM_{2.5}), at current levels is estimated to cause around 1,000 deaths per annum (TfGM). Some groups, including the young, old and those with existing lung or health conditions are particularly at risk. For those affected, life expectancy is reduced by an average of over eleven years with consequential impacts on health and the economy. The 'National Air Quality Strategy' (DEFRA 2007) stated that poor air quality costs the UK between £8.5 billion and £20.2 billion a year. Rapid action is needed to reduce ill health caused by air pollution.

Our work in understanding climate adaptation has identified that there is a correlation not only with poor air quality and the most deprived and vulnerable communities, but also in locations and communities most susceptible to flooding and a changing climate. Although Greater Manchester is relatively well positioned to withstand climate change from a global perspective, the increasingly volatile weather and indirect impacts on food supply and migration will have significant implications for Greater Manchester's future economy.

FACT: The temperature in England has already risen by more than 1°C since the 1970s and 2006 was recorded as the warmest year for 348 years. In Paris, in 2015, the international community reached agreement to limit climate change to below 2°C above pre-industrial levels, beyond which point the climate risks would be 'dangerous'.

Northern cities are critical to the UK's carbon reduction and low carbon economic challenge. The Northern Powerhouse concept, new governance and delivery arrangements and devolution of health, planning and transport powers, provide the building blocks for Greater Manchester to deliver a powerful transition to a low carbon and low emissions economy. Such a transition requires decreasing fossil fuel consumption, improving system-wide energy efficiency and increasing renewable energy generation.

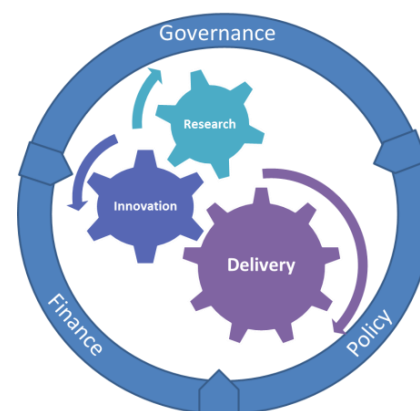
FACT Sector: In 2012/3, the Low Carbon Environmental Good and Services sector in GM was the 3rd largest in the UK. It employed 37,000 people within GM and has annual sales of over £5billion, showing annual growth of around 4% with particular growth in the renewable energy sector at 5.6%.

We are now half way through our 2012-2020 Climate Change Strategy. To meet its' objectives we will need to secure a significant step change in national and local action to deliver a further 4 million tonnes of carbon reduction from our 2013 performance. Around £300-500m low carbon energy generation projects need to be implemented. This includes heat and power generation schemes to be deployed by 2020, building on and expanding existing work in some authorities to deploy energy generation technologies including PV, heat networks, wind, smart heat, and energy from waste and decarbonising vehicles using Greater Manchester's roads.

However, there is still a gap of circa 0.5 million tonnes between currently identified projects and our 2020 target, so more interventions need to be developed. Seven of GM's authorities have already committed to eliminating fossil fuels by 2050 as part of a 100% clean energy pledge. This will have significant implications for the extent to which GM will need to act early to deploy additional local renewables generation and storage. We will work with the hundreds of organisations who have directly contributed to the development of this Plan, and want to reach out to every community in Greater Manchester to deliver a cleaner, greener, more secure future for our great city region.

2.1 Funding the Plan

It is important to note that, although required resources are outlined in the plan, many critical actions rely on using small amounts of funding and capacity to leverage significant further investment and action by others. Some actions rely on being successful in bids and proposals in competitive processes and many rely on ensuring policies are effectively implemented across GM's investments and activities. If the targets are to be achieved, all partners will need to commit fully to utilising mainstream projects and funding to deliver our low carbon goals.



Key funding streams that need to be utilised include:

- Ongoing and increasing access to low carbon levies and taxes, including ECO funding for retrofit;
- EU funding, including Horizon 2020, INTERREG, ELENA and other transnational funds;
- ERDF funding, particularly for market reform, business productivity and energy efficiency and renewables infrastructure deployment;
- EPSRC, Innovate and other UK research and innovation funding – over £100 million of energy and low carbon research is in place across GM's universities;
- Local Authority revenue and investment funding, including asset management/renewal and capital programmes;
- Private Investment by national and international companies in energy and transport infrastructure and personal investment by individuals in the selection of cost-effective low carbon goods, services and property upgrades;
- DBEIS and OFGEM Heat Network, smart networks and energy system transformation funding;
- Increased access to energy generation and sales income for reinvestment in local initiatives;
- Devolved Health funding, particularly in addressing cold homes, lifestyle and air quality challenges;
- National, international and local Transport funding; and
- Housing and employment building stock investment funds, to ensure low carbon stock is deployed.

Studies by the UK Committee on Climate Change have identified the cost of interventions as around £1,000 per tonne of CO₂e permanently cut so, based on Greater Manchester's current emissions of over 15 million tonnes (2103), around £15 billion pounds of investment would need to be aligned with low carbon goals in order to wholly eradicate direct emissions by 2050, with earlier cuts having a much greater positive impact on global climate change.

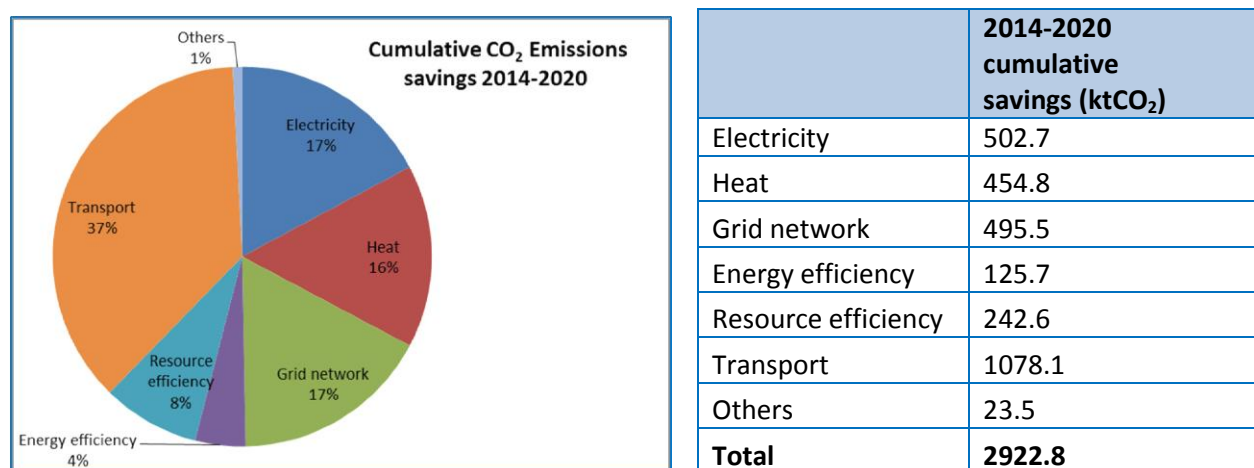
However, this £15 billion includes many existing and planned major infrastructure and socio-economic investments e.g the metrolink, energy networks, business productivity programmes and new, low carbon buildings. Also, this investment is not a 'net' cost – setting aside future climate considerations, significant direct financial returns and wider socio-economic returns on investment (health, growth etc) are anticipated to outweigh the investment.

2.2 Plotting a Path to a Low Carbon Future

Recognising that there is no single 'silver bullet' which will reduce emissions sufficiently; we require a portfolio of action and choices across all aspects of society, each reducing emissions against a business as usual scenario. As part of the development of this Plan we undertook a 'Carbon Wedges' study, originally developed by Princeton University as a way of communicating this concept. By adding individual 'wedges' of carbon reduction measures together, it created "one" possible pathway to the target.

Over the period 2013-2020 emissions needed to fall 4.43mt from 15.43mt to 11mtCO₂, over the 7 year period. These reductions were grouped into one of four categories (National Action, National Action with Local Influence, Local Authority sector (funded and proposed) and Business, Wider Public sector and Individuals). An assessment of their impact led to an understanding that over half of GM's emission required national action and there is still a significant shortfall between planned actions and Greater Manchester's 2020 target. It also identified that the most significant factors affecting recent data trends were the carbon intensity of nationally supplied electricity and the annual temperature pattern, with cold springs and autumns having a significant impact on emissions.

Following the consultation, further work was commissioned from the Tyndall Centre to refresh our understanding of the contribution made by different wedges, and the results of this have been integrated into the Impact Column of section 5.2 of this Delivery Plan. This more recent analysis by Tyndall has identified that, from a 2013 baseline, 2.9 million tonnes of savings will be delivered by 2020 if all of the existing and planned actions in Section 5 of this Plan are fully implemented.



A further 1 mtCO₂ of cuts can be estimated associated with background (largely national) activities on buses, goods vehicles for transport, emissions savings on the electricity and heat used, which are importing from National Grid, improvements in commercial sector and other sectors such as agriculture. This leaves at least 0.5 million tonnes of savings to be identified between now and 2020 beyond the proposed programme, plus additional potential savings to account for short term growth in the population and economy. Work already planned which could have mid and long term impacts beyond 2020 has the potential to cut emissions by a further 4 million tonnes if the highest standards are set, and the measures are fully implemented.

2.3 Assumptions

Forecasted fluctuations in economic growth, economic mix and population between now and 2020 broadly offset each other from an emissions perspective, and are less significant than factors such as annual weather variation or use of coal in national electricity generation. The renewable generation capacity towards 2020 is based on the current trends in deployment for all the technologies using DBEIS's Renewable Statistics dataset. For PV, wind and hydro, the annual capacity increases by 20% whereas for bio-energy technologies the increase is 5%. The CHP capacity, is based on the dataset provided by GMCA. Currently about 1% of GM properties are installed with smart meters for gas and electricity. The forecast model assumes smart meters will be installed in all properties across GM by 2020 in line with the national policy. Further details on the assumptions made under this analysis are provided in Annex A and will be refined as part of ongoing work to set targets, strategies and milestones for 2050.

3 THE CRITICAL ACTIONS – WHAT NEEDS TO BE DONE?

These ten critical actions have been identified based on the commitment and knowledge of all sectors across Greater Manchester. They represent what we know needs to be done to achieve 2020 targets and lay strong foundations for our journey to a longer term future low carbon economy and society.

We recognise that significant action is needed in all areas and sectors of society; achieving our goals will require major interventions in infrastructure and policy, as well as engaging all aspects of our community in cumulative small actions. National action is a critical part of this. Within this broader landscape, there are a number of critical issues and actions which will have a cross cutting and transformative impact on all 5 headline goals, enabling and supporting others to take action.

These include:

- 1 **MAJOR INFRASTRUCTURE CHANGES:** Identifying spatial, technological and market opportunities and funding to deploy the type and scale of energy efficient/low carbon development, generation, distribution, storage and smart technologies required to deliver carbon and emission targets.
- 2 **REDUCING FOSSIL FUELS IN TRANSPORT:** Decreasing reliance on fossil fuels across all transport activities and influencing how and when people choose to travel.
- 3 **LIVING LOW CARBON LIVES:** Reaching out to Greater Manchester's communities, to increase understanding of the opportunities and implications of climate change, incentivising and supporting action to make the transition to a low carbon economy.
- 4 **TRADING ENERGY INTELLIGENTLY:** Intervening in how energy is traded to ensure cost effective energy efficient/low carbon energy generation is prioritised at cost effective and fair prices for consumers.
- 5 **SUPPORTING CLEAN BUSINESS:** Supporting our businesses to become more resource efficient, access new low carbon market opportunities and make the transition to a low carbon economy.
- 6 **MAKING INFORMED DECISIONS:** Making sure our existing and planned major investments, assets, purchases and programmes comply with our climate change goals.
- 7 **PREPARING FOR A VOLATILE CLIMATE:** Addressing the existing and future effects of climate change, equipping residents, businesses and communities with the skills and resources needed to be fit for a changed climate.
- 8 **LOCAL TO GLOBAL CLIMATE ACTION:** Using local experience to shape national and international performance, by negotiating with national government to continue to secure devolved responsibilities, funding, freedoms and flexibilities and collaborating with local, national and international cities and partners to secure supportive legal, policy and fiscal frameworks.
- 9 **REINFORCING THE RIGHT BEHAVIOURS:** Make sure our plans have the intended effect, by considering setting and enforcing clear standards and a more diverse landscape of incentives and penalties to ensure that the required results are achieved.
- 10 **PLANNING FOR THE FUTURE:** We will put in place post 2020 targets, plans, programmes and key milestones to reach a clean energy future, and integrate these across GM's wider strategies, plans, policies and projects.

4 PROGRESS TO DATE

Over the period of the previous Implementation Plan, Greater Manchester has created a strong platform for future delivery. This page provides an overview of our achievements across the 5 Themes of the Climate Change Strategy (Energy, Buildings, Natural Capital, Transport and Sustainable Consumption and Production) and the two cross cutting Themes (Adaptation and Skills & Sector Growth).

Energy	Buildings	Natural Capital
<p>Energy Generation: 120MW of renewable electricity generation capacity is now in place, producing around 360GWh electricity per year:</p> <ul style="list-style-type: none"> ❖ Direct deployment and 'rent a roof' Photovoltaic cells – 28,000 by end 2014. ❖ Hydro-generation in Stockport, Rochdale and Oldham. ❖ Heat generation schemes include: <ul style="list-style-type: none"> -High rise biomass in Stockport; -Air source heat pump deployment in Bury, Manchester, and Wigan. ❖ GMWDA anaerobic digestion and 'energy from waste' plants. ❖ £270m was invested by ENWL in transforming the distribution system in 2013. GM is pioneering work on the transformation of domestic heat, system balancing of energy at local grid scale, energy storage and capacity trading. £52m on energy innovation reduced energy losses and boosted the ability of the grid to take new connections of demand and renewable supply. ❖ A minimum of £110m in energy research income in 2013 has been secured across GM's academic institutions. ❖ Tariff trials and switching campaigns reached 57,000 residents, with 12-15% residents actively taking up the local offer. ❖ Investment pipeline of £200m in heat networks, energy efficiency and generation projects identified. 	<p>Domestic:</p> <ul style="list-style-type: none"> ❖ Since 2011/12 GM partners have installed over 27,000 retrofit measures in private sector homes, saving an estimated total of 15,000 tonnes/year and 50,000 tonnes/year of CO₂ were saved from 100,000 installed measures via social housing partners' activity since 2010. ❖ GM outperforms most areas of the UK, doubling its share of ECO grant for households during 2013/14. <p>Non Domestic:</p> <ul style="list-style-type: none"> ❖ Baseline data in place for GM LA buildings retrofit projects. ❖ Business cases developed for 379 LA buildings including schools, across 5 local authorities, totalling £19m investment opportunity. ❖ This has led to a MoU with Salix Finance to provide at least £10M of 0% finance over three years for GM low carbon demonstrators. ❖ Two demonstrators include a £3m investment in the 1st wave of school retrofit programmes, and a circa £1m RE:FIT corporate buildings programme, is expected to save in excess of 10k tCO₂e. 	<ul style="list-style-type: none"> ❖ Designating the 'Great Manchester Wetlands' as GM's first Local Nature Improvement Area and securing HLF funding for significant habitat enhancement projects. ❖ Delivering 2 of the 4 national DEFRA Payments for Ecosystem Services Action Learning Projects. ❖ Secured a proportion of a £14m Life Integrated Project to provide capacity for Natural Capital activity and improve water quality. ❖ Pilots in the Irwell Catchment and supporting the establishment of the four GM River Catchment Partnerships. ❖ Delivering a range of other physical environmental improvement projects including 'turning the red river blue' on the Medlock and the de-culverting of the River Roch through Rochdale Town Centre. ❖ Representing and advocating GM's natural environment interests on other key groups such as the NW River Basin District Liaison Panel, and the Atlantic Gateway Parkland's initiative. ❖ Tree planting schemes and initiatives across the authorities have delivered over 5 million new trees. ❖ Increased the number and ranking of parks and woodlands with nationally recognised quality management designations.

Case Study: Breathing life into buildings

In 2014, SMBC appointed Carillion Breathe to undertake a detailed energy audit of 112 buildings in the corporate estate. A £1.53m programme of measures provides significant opportunity for energy (15.8%) and carbon emissions (13.6%) reduction, and in addition providing infrastructure upgrade, improved resilience and an ongoing 22% reduction in maintenance costs. Works on over 50 buildings are forecast to be complete by the end of 2016.

Case Study: Building a future of sustainable engineers

The GM University Technical College (The GM) is shaping the future workforce and leaders of tomorrow by developing the work-ready experience and skills needed to start a career in sustainable engineering. 150 new students each year will benefit from learning in a building which has been designed to include all the latest sustainable technologies including its biodiesel CHP energy, heating and cooling systems. Hands on experience of live building technology is one of the many ways in which 'real' engineering is integrated into the curriculum.

Transport	Skills & Sector Growth	Climate resilience	Sustainable Consumption
<ul style="list-style-type: none"> ❖ Delivery of Metrolink line to Rochdale Town Centre 2 months ahead of schedule and to the Airport 12 months ahead of schedule. ❖ 167 electric vehicle charging infrastructure stations delivered, and over 2,500 GM registered e-vehicles. ❖ GM awarded £42 million to fund the development of the City Region's cycling strategy, Velocity 2025. ❖ Through LSTF funding, four cycle hubs opened in Rochdale, Ashton-under-Lyne, Bury and the Regional Centre. ❖ Established baseline carbon emissions from transport. ❖ Introduction of 3 fully electric buses and 17 hybrids operating as part of the Metroshuttle service in the regional centre. ❖ Introduction of a scheme to enable travel choices and business engagement to a wider potential audience. ❖ Rail electrification work and the development of the Northern Hub. 	<ul style="list-style-type: none"> ❖ Developed and published a suite of low carbon 'propositions' plans to drive inward investment in the sector. ❖ Mapping of and embedded monitoring of the overall growth of the LCEGS sector into annual GM KPIs. ❖ Delivery of 3 'Tendering Successfully' workshops to over 20 SME's to increase local SME's ability to get on major frameworks. ❖ Over 100 LCEGS companies have joined a new online platform launched to help map and promote the capabilities of the low carbon sector in GM. ❖ Green technology colleges opened in 4 authority areas. 	<ul style="list-style-type: none"> ❖ A thorough academic understanding of GM's key Climate Change (CC) risks and their spatial impacts, identifying our most at risk and vulnerable communities. ❖ Considered climate impacts, particularly flood risk, through our spatial planning and utilities and infrastructure investment processes. ❖ Actively plan and prepare (through GM Local Resilience Forum) for climate and extreme weather impacts on our people and communities. ❖ Signed up as a role model city to the UNISDR's resilient cities campaign and also to the EU's Mayors adapt initiative. ❖ Been successful in securing additional funding and action to implement the 'Disaster Resilience Scorecard' for GM. ❖ Became a full partner in the H2020 Climate Resilient Cities and Infrastructures project, securing 1m Euros for AGMA and University of Manchester to support planners and decision makers in GM over the next 3 years to increase our climate resilience. 	<ul style="list-style-type: none"> ❖ Establishment of a resource efficiency business support service as part of the Business Growth Hub which has delivered: 884 businesses assisted, £16.5m of sales won/safeguarded, £12.5m in cost savings identified (£2.2m realised), 36 Kt of annual CO₂e savings identified (2.2 ktCO₂e realised). ❖ Municipal recycling rates and levels of waste diverted from Landfill are increasing and the UK's largest PFI has delivered major new waste and energy infrastructure. ❖ Research on understanding low carbon behaviours and carbon foot-printing of GM food chain. ❖ A new, GM-wide, online Green Growth business pledge has been launched. ❖ Cooler have engaged 6 local authorities and 20 Registered Social Landlords and many businesses in Carbon Literacy. ❖ Development of a GMCA wide Social Value Procurement Policy to improve the carbon footprint and utilisation of local businesses in the supply chain. ❖ A consortia of media organisations has developed a new standard for sustainable programme making, and rolled out a carbon literacy programme to their employees.

Case Study: Resource Rescue – GM Fire Fire services do not pay for water to extinguish fires, so it's no surprise that fire services do not accurately measure the amount of water it takes. Recognising that this costs money and carbon, GMFRS fitted flow meters to seven of its fire engines, capturing and sending back real-time information on how much water is used at each incident attended. This ground breaking research will help inform future firefighting techniques and the specification of our vehicles and equipment. Over the last 3 years fire fighters have experimented and developed techniques for capturing fire water run-off and recirculating it back onto the fire, reducing water use and preventing pollution. This innovative work now forms part of national guidance for fire services.

Case Study: Rochdale PV
In September 2014, Rochdale Council began a programme of solar PV installations on council land and buildings. To date three solar PV arrays with a total capacity of 600kW are in place costing £550K, constructed by Southern Solar Ltd. They will generate an estimated 550MWh/year and save 290 tonnes of CO₂.

5 THE DELIVERY PLAN

5.1 PLAN AT A GLANCE: 2020 Vision and Priorities

Through consultation feedback, a clear set of priorities that are required to achieve our 2020 target have been identified.

SECTOR AND SKILLS

Make a rapid transition towards a low carbon economy by 2020, enabling businesses to optimise their potential, raising the profile and increasing the economic contribution of the sector and co-ordinating support in GM to further develop the sector.

In order to ensure that Greater Manchester directly benefits from the opportunities created by a global drive to cut carbon and adapt to a changing climate we need to:

- Support appropriate GM businesses to diversify into low carbon business activities
- Attract high value low carbon and environmental goods and services sector businesses to Greater Manchester
- Promote the existing low carbon and environmental goods and services sector and help it to grow
- Develop and integrate the skills required for this change into existing and future workforces

NATURAL CAPITAL

By 2020, our natural environment, and the ecosystem services it provides, still need to be both protected and (where possible) enhanced in light of increasing pressures from people, the economy and a changing climate. Our natural capital must also be embedded into the decision-making for sustainable economic growth investments, enhancing their success and resilience.

The GM Natural Capital Group (NCG) will act as an ambassador for the natural environment, providing leadership and co-ordination for activity across green infrastructure, waterways and biodiversity. By 2020 we will seek to achieve:

- No net loss in habitat quality or extent from a 2014 baseline
- A year on year increase in the external funding secured for delivery of physical natural environment enhancement projects
- Over 3 million trees planted (by 2035) and natural capital embedded into our investments
- The transparent and informed consideration of natural capital impact in investment decision making

SUSTAINABLE CONSUMPTION AND PRODUCTION (SCP)

By 2020 we need to have a better understanding of the qualitative and quantitative contribution sustainable consumption and production makes towards GM's low carbon ambitions. This will be widely communicated and commensurate with the scale of the challenge and opportunity.

To achieve this we need to work with the public and private sectors to transform how resources are procured, used, consumed and disposed of, using public sector procurement to stimulate public sector resource efficiency (excluding building fabric) and market growth. Low carbon practices need to be embedded within procurement and other services through increased knowledge and training as part of both publically funded business support activity and private sector lead activity.

Priorities for future action include:

- Supporting businesses, residents and the public sector to improve their resource efficiency
- Increasing the sustainability of our waste collection and disposal systems
- Increase the efficiency of resource use within Local Authorities and wider public sector

CLIMATE RESILIENCE

We already have a good understanding of our climate risks and how to plan and respond to the extreme events associated with them. By 2020, we must ensure we deliver a resilient and 'well adapting' GM by applying this knowledge and integrating it into all actions. This will increase the physical resilience and adaptive capacity of GM's people, places and businesses to climate change.

As a priority for future action we need to:

- Use our increased understanding of climate change impacts to increase our resilience
- Increase further the resilience of our businesses
- Address the wider impacts of climate change on our building stock
- Embed actions for increased resilience into our plans and strategies

ENERGY

By 2020, we will establish the necessary capacity and policy framework to accelerate the implementation of energy generation, distribution, storage, trading and smart systems schemes across Greater Manchester

Over the next five years, Greater Manchester will need to significantly accelerate the rate and scale of deployment of new generation and take a firm hand in the deployment of smart systems to reduce energy consumption and shift or reduce peak demand. Combined efficiency and renewable generation action needs to take between 3 and 5 TWh of fossil fuel based energy consumption out of the system. Energy Security is a significant issue, and Greater Manchester will need to buffer itself against both price and availability impacts that will arise from any shortfall in generation emerging between 2018-2025. Priorities include:

- Accelerating the delivery of an investment pipeline of approximately £200m low carbon energy generation and efficiency project including: heat network, street lighting and renewable energy;
- Deploying smart energy systems, including storage, which will enable energy consumers to understand their usage and to actively minimise their bills via demand shift;
- Trading energy differently, by seeking to establish a GM Energy Company (GMEC) as part of a wider ambition to establish Energy for Greater Manchester, comprising generation, network, services and retail companies; and
- Establishing a clean energy masterplan and creating financial instruments, planning and policy frameworks to progress almost every opportunity for low carbon generation.

TRANSPORT

By 2020 carbon targets will be a core delivery focus and goal of transport strategy and planning – we will develop, gain funding for and deliver transport interventions which enable GM to reduce its emissions, adapt to climate change, improve air quality, raise awareness of the carbon and health impacts of transport choices

Over 95% of Greater Manchester's transport emissions come from road vehicles and, at present, private car users generate 67% of CO₂, 53% of PM₁₀ and 52% of NO_x road transport emissions. Continued encouragement in the uptake of smarter travel choices is important, however as journeys by public transport, cycling and walking tend to be relatively short, mode shift has a lower impact on emissions than might be expected. The introduction of ULEVs will help to reduce impacts on both short and long journeys in GM. HGVs and buses make up a relatively small amount of road transport but contribute significant amounts to emissions. Public transport accounts for 15% of GM emissions which means that there is limited scope when it comes to reducing emissions through public transport efficiencies. The key priorities therefore include:

- Changing Travel behaviour;
- Reducing emissions from Heavy Good Vehicles and passenger vehicles;
- Implementing Planned Infrastructure improvements for sustainable transport including rail electrification;
- Stimulating the Uptake of Ultra Low Emission Vehicles (ULEV), particularly private car users;
- Reducing emissions from buses on key local corridors; and
- Improving Air Quality and identifying Clean Air Zones where viable.

BUILDINGS

By 2020, we need to significantly improve the energy performance of GM buildings, making our buildings more affordable and comfortable to occupy.

GM's challenging targets can only happen with a combination of sustained proactive national policy and aligned priorities and resources from GM. New mechanisms to balance up-front investments in energy efficiency with the rewards of lower long term bills are needed in both new build and existing home and building refurbishment activities if the ill health, poverty and productivity impacts of inefficient stock are to be addressed. Continued support for domestic smart energy generation and efficiency and new activity to upscale local authority energy efficiency in public buildings, including schools, are envisioned, plus encouraging efficiency in the wider public and private sector estates; the latter requires further investigation to better understand the potential savings. Strategic actions include those that will enable and deliver:

- Replacement of poorly performing domestic and commercial stock with low carbon development
- Developing previously used and brownfield land to deliver resilient, resource efficient building stock and infrastructure;
- A financial, regulatory and framework to support value for money building retrofit activity;
- Energy and resource efficiency and smart heating in social and private housing, public and commercial buildings;
- Interventions across Health, Local Government and key partners to reduce home and energy-related poverty and poor health outcomes; and reduced emissions from all new development.

5.2 MITIGATION:

Goal 1: Our collective carbon emissions will have been reduced by 48% between 1990 and 2020

Goal 2: We will support UK Government in achieving EU Air Quality thresholds at the earliest opportunity to reduce ill health in Greater Manchester.

Target: To deliver a reduction in annual emissions of 4.2 million tonnes of CO₂ from the 2013 baseline, and identify a pipeline of schemes and initiatives to deliver a longer term zero emissions target.

Purpose of Actions: From a 2013 baseline, 2.9 million tonnes of savings will be delivered by 2020 if all of the existing and planned actions below are fully implemented. The impact of each Action is estimated in the table below.

Theme	Action	Led by:	Resources	Impact (tCO ₂)
Cross Cutting	M1: Consider how best to use spatial plans and related levers in order to achieve compliance with GM's current and 2020+ low carbon aspirations, and advocate increasing well-connected, dense urban development.	GMCA PHE Teams	GMCA revenue	Long: 1 million
Energy	M2: Undertake detailed master-planning and design a long term energy infrastructure plan and map for Greater Manchester through the Energy System Catapult's Smart Systems and Heat Programme.	GMCA Env Team, DBEIS, ESC	ETi/GMCA Funding	Long: 1 million
	M3: Deliver a large-scale demonstrator of smart heat systems within Greater Manchester to test and explore the viability of the Masterplan.	GMCA ESC DBEIS	DBEIS, ERDF	5,000 (Est.)
	M4: Deliver current pilot of heat pump installation in social homes, supporting tenants with the change, and extend pilot to deploy a wider demonstration of integrated heat pumps, heat networks and demand aggregation in domestic dwellings to provide a financially viable offer to private landlords and owners.	GMCA Env Team, NEDO, Hitachi, & landlords	NEDO, DBEIS, Hitachi, ALMOs	3,600
	M5: Deliver existing PV projects and establish a pipeline of local authority-lead photovoltaic installations.	LAs and LCPDU	Cap Ex Inv Fund	206,900
	M6: Complete Local Authority lead onshore wind assessments and deliver a programme of onshore wind investments. Identify and progress alternative electricity generation including biomass, hydro etc.	LAs, Peel & GMCA	Cap Ex, Inv Fund	102,400
	M7: Deliver a programme of identified local energy efficient heat networks and plan for their longer term integration.	LAs, LCPDU	ERDF Inv Fund, Cap ex, ELENA,	177,500
	M8: Review existing research, assess the potential for and continue to promote deployment of alternative small, mid and commercial heat energy across GM. If viable, develop appropriate schemes.	LCPDU, Local Authorities	Cap Ex, Inv Fund	339,400
	M9: Replace Greater Manchester's street lighting and signals with smart LED systems.	LAs LCPDU, TfGM	ELENA, Salix	117,600
	M10: Deploy a smart distribution system (DMS) with dedicated communication network for the whole ENW network by 2018 and deliver a £50 million programme of smart network changes and integrated storage pilots to promote connection of decentralised energy, and deploy smart meters for gas and electricity.	ENWL, Schneider GMCA, MCC, Carbon Co-op, retailers	Private Sector ENWL, OFGEM, EU Horizon	495,500
	M11: Expand and extend community energy partnership initiatives across the whole of Greater Manchester.	GMCA – Oldham MBC	DBEIS, GMCA capacity	Enabling
	M12: Develop alternatives to existing energy systems, including hydrogen and other storage initiatives.	GMCA, Universities, Viridor	EU Funds and UK Research	Enabling
	M13: Seek to identify and accelerate energy generation schemes that the private sector and community groups could bring forward.	GMCA Env Team	GMCA, DBEIS	Enabling
	Buildings	M14: Work with commercial building owners and major occupiers to increase commercial building retrofit e.g. through access to finance and improving transparency of real energy performance.	LAs, Private sector partners	GMCA cap ex Revenue & ERDF
M15: Introduce and facilitate a locally-delivered education programme for commercial building owners, investors and financiers on investment risks arising from poor energy/environmental performance, and the business case for delivering improvements.		GMCA and UK Green Buildings Council	GMCA revenue	Enabling

Theme	Action	Led by:	Resources	Impact CO ₂ (t)
Buildings	M16: Identify and deliver programmes to replace poorly performing stock with low carbon development, particularly where this can also address ill health, poverty and productivity challenges.	GMCA	ERDF, Inv Fund	MID: 250,000
	M17: Identify and deliver programmes to develop low carbon stock and energy efficient infrastructure on previously used and brown field land.	GMCA	ERDF, Inv Fund	MID: 250,000
	M18: Complete existing and support the delivery of future national domestic energy efficiency and fuel poverty schemes e.g. ECO.	GMCA, ECO, Health	ECO, DBEIS, Landlords,	41,200
	M19: Seek agreement to develop and deliver a £6 million Salix matched recycling fund for energy efficiency in Local Authority owned buildings	GMCA LCPDU	SALIX, local authorities	84,500
	M20: Work with partners on similar energy efficiency programmes in schools and other public sector estates.	LCPDU, Public sector	SALIX, public sector match	
	M21: Consider a campaign to better enforce existing building standards, licensing and regulation across Greater Manchester's building stock.	Local authorities	GMCA and LA revenue	MID: 1 million
SCP	M22: Support businesses, organisations and people to be more resource efficient by doubling the impact of resource efficiency support to SMEs, and develop complimentary services within the existing offer.	BGH	ERDF	125,000
	M23: Increase the sustainability of the waste collected from homes by: reducing void capacity within the Municipal Waste Collection System; increasing the value of recyclates / energy removed from the waste stream; and Increasing kerbside collection recycling rates through communication, reducing residual waste capacity/void space and proportionate enforcement to contribute to an overall Greater Manchester recycling rate of 50%.	GMWDA	GMWDA budget	131,200
	M24: Improve shared services by developing Household Waste Recycling Centres to increase recycling, composting and diversion from landfill, to 81.3% in 2015/16, 82% in 2016/17 and 85% in 2017/18. Undertake targeted campaigns to around 10% of GM households.	GMWDA	GMWDA budget	
Natural Capital	M25: Plant 3m trees across GM by 2035 as part of the City of Trees initiative, to create shade, manage water and sequester carbon.	CoT, LAs, MAG	Grant, Private	MID: 14,400
	M26: Improve the management of our key CO ₂ sinks, targeting activity on our key habitats – such as lowland and upland peat bogs.	NCG partnership	NCG partnership	20,000 (Est.)
Sector & Skills	M27: Use inward investment activities to attract businesses most likely to deliver carbon efficient GVA growth, by meeting Greater Manchester's resource and service needs with the least carbon footprint.	BGH / MIDAS	Revenue budget	Enabling
Transport	M28: Deliver new infrastructure to cut emissions, including Cross City Bus, Leigh Salford Manchester Busway, Rail Electrification and Cycling Infrastructure expansion and optimise use of new metrolink lines.	TfGM	TfGM cap ex	85,400
	M29: Reduce emissions from buses on Key Urban Corridors by: setting minimum standards for bus vehicles using the Cross-city Bus Infrastructure and future bus priority schemes and identifying cost-effective ways of accelerating the replacement of pre Euro IV buses and seek to establish consistent bus emissions standards across GM.	TfGM	TfGM revenue	MID: 0.2 million
	M30: Stimulating the uptake of ULEVs, by making the case for funding to stimulate deployment of electric vehicles, aiming to have 40,000 registered in GM by 2020, and investigate the potential to introduce joint procurement and common travel policies for GM's public sector.	Local Authorities, TfGM	TfGM and local authority revenue	282,200
	M31: Demonstrate the potential of alternative fuel transport, aiming to achieve regionally/nationally compatible solutions.	TfGM, Universities	INTERREG,	enabling
	M32: Work with local authorities to set stricter emission standards for taxis and consider clean air zones.	TfGM, LAs	TfGM & LA revenue	5,000 (Est.)
	M33: Reducing emissions from heavy good vehicles by developing a freight and logistics strategy which will include supporting new rail or canal-served distribution centres, subject to planning conditions.	TfGM, Key freight co's	TfGM revenue and cap ex.	MID: 0.5 million
	M34: Implement mechanisms on the Key Route Network to reduce congestion and improve journey time reliability (incl. fleet efficiency).	TfGM, freight co's	TfGM	710,400

5.3 LOW CARBON ECONOMY

Goal 3: We will make a rapid transition to a sustainable low carbon economy

Target: To expand Greater Manchester's LCEGS sector from its (2012) 37,000 employee and £5.7 Billion GVA contribution at a faster rate than GM's base level of economic growth, and to divert existing fossil fuel spend towards local low carbon GVA.

Target: To create financial instruments, regulatory and enforcement initiatives, decision tools and organisations to support and facilitate the development of a low carbon economy, ensuring that climate change is accounted for in key decisions and actions.

Purpose of Actions: These are necessary in order to secure the capacity, skills and funding, and put in place the necessary structures, mechanisms and processes to deliver the emissions reductions impacts outlined above. They are also important to ensure GM can fully access the opportunities of a low carbon global economy. The impact of these actions will be identified as part of the Key Performance Indicators (KPIs) and Operational Performance Measures (OPMs) outlined in Section 6.

Theme	Action	Led by:	Resources
Cross Cutting	E1: Develop a Climate Change Strategy for 2020+, supported by clear Targets and Plans compliant with international commitments.	GMCA Env Team, LCH.	GMCA revenue,
	E2: Lobby government for greater local determination of national funds for power and heat generation, distribution, innovation, storage, demand response and reduction.	GMCA Env Team	GMCA revenue
	E3: Develop costing methodologies and investigate the potential for GM financial instruments (e.g. green bonds) to stimulate commercial property retrofit activity, and related infrastructure investment.	LCPDU	GMCA revenue
	E4: Develop a comprehensive low carbon, climate change and water evidence base to inform the Greater Manchester Spatial Framework.	GMCA Env Team	GMCA and EA revenue
	E5: Review the GM and Treasury Cost benefit analysis tool to identify climate change and carbon costs, impacts and benefits.	GMCA Env Team, DBEIS	DBEIS
	E6: Identify and implement emissions trajectory planning and project impact tools in order to inform and establish robust long term targets and priorities for Greater Manchester.	GMCA Env Team	WRI, Tyndall, GMCA
Energy	E7: Build a business case for and, if viable, develop and operate a municipal energy company and supplier licence for GM to strengthen the link between local spend and local investment.	GMCA, LCPDU	GMCA revenue & Investment
	E8: Subject to viability, establish a UK-wide district energy procurement agency to support the cost effective development and delivery of heat networks.	LCPDU	DBEIS
	E9: Encourage the development of commercial and community-lead energy, including wind, heat, biomass, PV, hydro-energy and other renewable and low carbon projects through supportive planning policies and facilitated access to funding and advice.	GMCA Env Team, LAs and Partners	TBC
	E10: Encourage the wider uptake of renewables in the domestic, private and wider public sector through power purchase agreements, finance and connection innovation.	LCPDU	Energy Co revenues
Buildings	E11: Lobby for changes to development viability assessments to ensure that occupant best value is better integrated into decision-making.	GMCA	GMCA Revenue
	E12: Develop new models for deploying retrofit in domestic housing stock. Work with Public Health to establish new schemes.	GMCA Env Team, Health	GMCA Revenue
	E13: Develop a clear financial and policy framework to accelerate and increase low carbon opportunities being realised in new build and refurbishment activities.	GMCA Environment Team	GMCA Revenue
	E14: Use financial Instruments to bring derelict, previously used land back into productive use for low carbon development and energy efficient infrastructure and replace poorly performing stock.	Core Investment Team	GM Investment Fund, ERDF

Theme	Action	Led by:	Resources
Sustainable Production and Consumption	E15: Develop toolkits and guidance to assist businesses in improving the activities of their supply chain with the aim of reducing emissions from heavy goods vehicles.	TfGM	TfGM
	E16: Increase the efficiency of resource use within Local Authorities and wider GM public sector by ensuring that Social Value clauses are included in public contracts, and that they are monitored and enforced.	Business Growth Hub, Public Authorities.	GM Env Team, BGH
	E17: Investigate and, if practical, support the development of a Sustainable Food Board for Greater Manchester.	GMCA	Feeding GM grant; Interreg
Natural Capital	E18: Identify funding to support Natural Deal skills development.	NCG, Skills and Employment Partnership	Tbc
Transport	E19: Change travel behaviour by introducing the 'get me there' smartcard system across tram, bus and train and introduction of an integrated fares system across all transport modes in Greater Manchester.	TfGM	TfGM
	E20: Encourage home and off-site working through improved Wifi and broadband use.	TfGM	TfGM, Digital Funding
	E21: Work with other agencies such as the DVSA, universities and the police to develop interventions which encourage safe and sustainable distribution.	TfGM, DVSA, Police	INTERREG bid
Sector & Skills	E22: Provide specialist business support to drive growth in companies in the LCEGS sector. Support others to diversify into the sector, delivering positive GVA impacts and helping to reduce their carbon emissions. Include expanding virtual networks to build understanding of local capabilities and serve as a directory of suppliers for local procurement.	BGH	ERDF
	E23: Promote and exploit the existing low carbon sector, by monitoring and measuring the overall growth of the sector in terms of jobs, sales and companies and raising the profile of the LCEGS sector in GM – e.g. via case studies, impact reports, GIS maps, research reports, virtual network.	BGH	ERDF
	E24: Exploit and promote the cutting edge research developed by our universities and harness the innovations that arise from it, including implementing eco-innovation projects.	GMCA Env Team, Universities	ERDF, Horizon, EPSRC, INTERREG,
	E25: Ensure that apprenticeship and training targets are met by procured GM delivery partners, identifying the skills demands that will be required to deliver the low carbon and transitional investments planned for GM.	SEP, GM Chamber	EU Funding, potentially European Social Fund
	E26: Work with colleges, universities and training providers to articulate needs for skills development in the GM low carbon economy, and bid for funding to deliver affordable training on low carbon building design specifically for the SME design / build sector.	SEP, GM Chamber, GMCA	European Funding, potentially ESF, revenue
	E27: Undertake specific skills, competencies and training, and workforce analysis, to ensure that the right skills in the right volume are being brought forwards to deliver a low carbon economy. Prioritise: CPD for existing trades to ensure that low carbon technologies can be promoted and installed; and professional and managerial competencies to identify and include carbon factors in decision making.	SEP, GM Chamber, GMCA, LCH Board partners	European Funding, potentially European Social Fund (ESF), revenue

5.4 ADAPTATION

Goal 4: We will be prepared for and actively adapting to a rapidly changing climate

Target: By 2020 we will have a clear understanding of the main climate risks faced by Greater Manchester and will have developed a stable, integrated working arrangement across key actors.

Purpose of Actions: These actions will position Greater Manchester to understand, quantify and act to mitigate key climate change risks. Greater Manchester has already complied with international protocols on climate adaptation including UN ISDR and Mayor's Adapt. Public disclosures as part of these protocols and an Annual Environment Report will enable monitoring of the impact of the proposed actions.

Theme	Action	Led by:	Resources
Cross Cutting	A1: Deliver a successful Water Framework Directive focused LIFE Integrated Project (Natural Course) to reform how catchment delivery is managed and accelerate water quality and management issue resolution.	Environment Agency, GMCA, UU, RT	LIFE + EU Funding EA
	A2: Deliver RESIN Integrated Project which will put in place tools and evidence to support enhanced climate change resilience – acting as an overarching resource to inform and support many of the actions listed.	GM Environment Team, UoM, EA	EU RESIN project, EA capacity
	A3: Embed Natural health outcomes in GM Public health activity and wider commissioning and provisioning activity.	PSR Team, GMCA Policy	GMCA revenue
Energy	A4: Review key energy infrastructure to assess its vulnerability to a changing climate.	ENWL/ GM Resilience	ENWL budget, RESIN
	A5: Assess the impact of weather extremes on the energy balance, to ensure that it is integrated into demand forecasting and capacity planning.	ENWL, GM Resilience	ENWL revenue
	A6: Strengthen the system to support priority customers during extreme weather incidents, especially where these result in power outages.	ENWL, GM Resilience	ENWL Cap ex
	A7: Consider the development of tariffs which support vulnerable users during periods of extra power demand for heat and cooling.	LCPDU (GMEC)	Energy Co revenues
Buildings	A8: Strengthen the resilience of building stock to a changing climate via developing guidance and pilots.	GMCA Policy	RESIN EA/GMCA capacity
	A9: Integrate responses to extreme weather into key public building management systems and staff communications.	GMCA Policy, Civil Contingencies	GMCA revenue
SCP	A10: Integrate climate adaptation advice into the green growth programme.	GMCA/BGH	RESIN
Natural Capital	A11: Develop GM's natural environment evidence base and local priorities and consider as part of the production of GM Spatial Framework.	GMEU	GMCA revenue
Transport	A12: Identify key risks to transport infrastructure posed by increased incidence of flooding and heat as part of Transport Strategy and Planning.	TfGM	TfGM / RESIN
	A13: Integrate requirements for shelter from extreme weather and heat into building design and transport systems as part of a sustainable design guide.	TfGM	TfGM, EU funds
	A14: Strengthen traveller notification systems to ensure that they respond to weather risks more effectively, including air pollution risks.	TfGM	TfGM

5.5 CULTURE AND COMMUNICATION

Goal 5: Low emission behaviours will become embedded into the culture of our organisations and lifestyles

Target: To provide the information, knowledge and incentives to enable Greater Manchester's organisations, residents and communities to act on climate change, and understand the issues and opportunities that affect them.

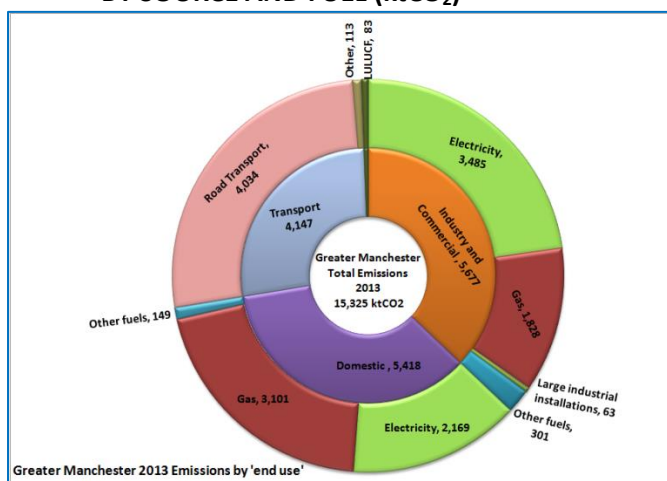
Purpose of Actions: Achieving a low carbon economy will require action by individuals and organisations at all levels and in all areas. The actions aim to provide a robust engagement and communications platform to encouraging changes to more positive, sustainable lifestyles. The most effective means to achieve culture change is via direct engagement in projects, so all of the actions listed above will also integrate education and engagement.

Theme	Action	Led by:	Resources
Cross Cutting	C1: Operate a Low Carbon Hub Board, with supporting task groups and networks.	GMCA Env Team	GMCA revenue
	C2: Publish disclosures as part of our external commitments e.g. Carbon Disclosure Project, Under 2 MOU, Compact of Mayors and Integrated Covenant of Mayors on their international websites.	GMCA Env Team	GMCA revenue
	C3: Maintain a suite of Key Performance Indicators and Operational Performance Measures to provide a robust basis for analysis of progress.	GMCA Env Team	GMCA revenue
	C4: Encourage organisations across GM to boost the carbon literacy of their employees via corporate schemes and the GM Carbon Literacy Project.	GMCA Env Team	EU, Partners
	C5: Maintain and regularly update a comprehensive online resource of articles, news, documents and reports, including quarterly progress reports and an Annual Performance Report.	Accountable Bodies, GM Env team	GMCA revenue
	C6: Seek to operate a communications, awareness and pledge initiative and provide updates on key issues and action via social media, signposting followers to the initiatives and actions of others.	GMCA Env & Mayoral Teams	GMCA revenue
	C7: Work with experts to develop an evidence base and related resources to support planning officers develop policy and implement measures which enable occupants to adopt low carbon, climate resilient lifestyles.	GMCA Env & Planning Teams	GMCA revenue
Energy	C8: Develop and refine our approach to tenant engagement on carbon reduction based on social research conducted as part of the NEDO integrated heat pump and ICT platform trials and digital support training.	Landlords, GMCA Env Team,	NEDO, Landlord revenue
	C9: Publish and maintain detailed information on the Energy Network, and provide regular updates on our projects, performance and Plans.	Electricity North West.	ENWL
	C10: Seek to use the development of energy trading to provide a new, more direct engagement with organisations and individuals across GM.	GMCA	GMCA revenue
	C11: Run and participate in heat network engagement and communication activities, including conferences.	LCDPU	DBEIS, HNDU
Buildings	C12: Develop an initiative which raises awareness of the links between domestic building quality, health and fuel poverty.	GMCA Env & Health	Tbc
SCP	C13: Operate a Green Growth pledge to engage businesses on resource efficiency, promoting a wider awareness of climate change and the issues and opportunities affecting them.	BGH	ERDF
	C14: BBC North, Peel, ITV and other key media organisations will continue to promote the ALBERT+ standard for programme making, and implement their employee engagement initiative, extending to new organisations.	Media Consortia	Private Sector
Natural Capital	C15: Engage communities in natural capital activities as a mechanism to connect them with nature and understand the role of natural capital in combatting climate change and its impacts.	LAs, NCG	LIFE IP/ GMCA revenue
Transport	C16: Continue to offer an extensive Travel Choices programme, to encourage people to switch more of their journeys to sustainable transport and to better manage their journeys and vehicle choices.	TfGM	TfGM Revenue
	C17: Work with industry and customers to raise awareness and actively promote sustainable distribution.	TfGM	TfGM revenue

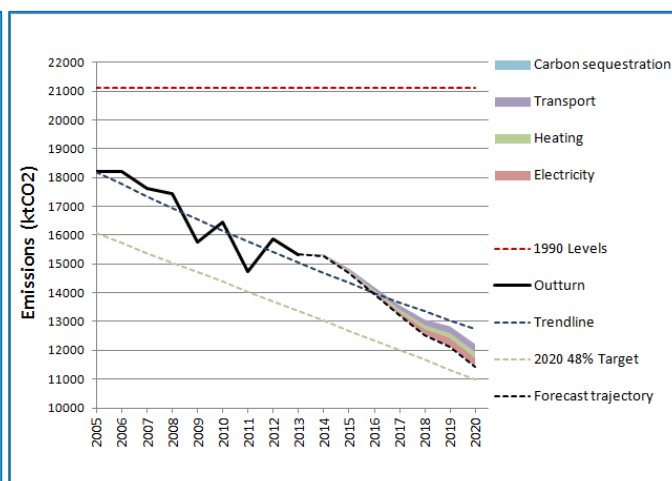
6 MEASURING AND MONITORING

Previous reports and targets have been established based on a DBEIS carbon emissions dataset published for local authority areas. This will continue to be used for the 2020 target. However, international standards and protocols require a broader approach to emissions inventories, and this will be used for setting future targets. This new emissions inventory will also be used for monitoring and analysing performance, and will be published to accompany this Plan. However, delays between taking action and data availability mean that a number of issue specific key performance indicators (KPIs) and operational performance measures (OPMs) are also required to ensure that projects and overall performance stays on track.

**GM CO₂ EMISSIONS 2013
BY SOURCE AND FUEL (ktCO₂)**



GM EMISSIONS 2005-2013

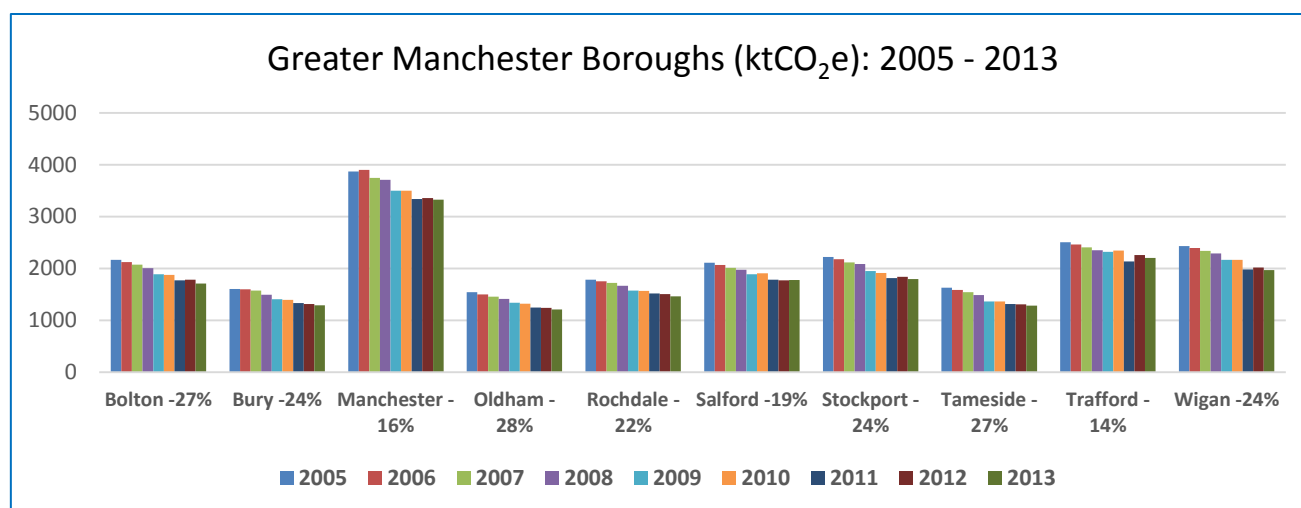


Progress on projects and targets, and more detailed analysis of trends will be publicly reported in quarterly performance reports submitted to the Low Carbon Hub Board. High level information will be provided as part of the GMCA's overarching Annual Report and a summary Annual Environment Report, first published in November 2015. These indicators will be incorporated into Quarterly and Annual reports showing trend analysis over time.

6.1 Overarching Key Performance Indicators (KPIs):

KPI description	Available data	2020 Targets (unless stated)
CO ₂ emissions (mt CO ₂)	15.325 (2013)	11 mtCO ₂ e
Tonnes CO ₂ /£m GVA	272	Na
GM Renewable Electricity Generation	0.36TWh (2013)	0.758 TWh
GM Renewable Heat Generation	0.025 TWh (2013)	0.56 TWh
Energy Consumption (Electricity)	2013: 11.75TWh	Non set
Energy Consumption (Gas)	2013: 21.64TWh	Non set
Percentage of people travelling other than by car	2012: 25%	35% (2018)
Properties in flood warning areas	2012: 30,000	
Proportion of journeys to work by GM residents made by non-car modes.	26% (2010/11)	26% (2016/7)
Index of cycle use, from up to 60 automatic cycle counters	107 (2010/11)	118 (2016/7)
LCEGS Sector:		
Number of companies	2013 = 2000	Non set
Number of employees	2013 = 38000	Non set
Value of sales	2013 = £5bn	Non set
Annual growth rate	2013 = 4.9%	Non set

6.2 Emissions by GM Local Authority: 2005-2013



6.3 Operational Performance Measures (OPMs): GM Local Authorities

MEASURE	Bolton	Bury	Manchester	Oldham	Rochdale	Salford	Stockport	Tameside	Trafford	Wigan	Greater Manchester
Total Emissions (million tonnes CO ₂)	1.475	1.089	2.826	1.011	1.222	1.512	1.525	1.084	1.918	1.662	15.325
Tonnes Domestic CO ₂ per capita (2013)	2	2.2	1.7	1.9	2	2	2.2	2	2.2	2.1	2
Installed Photovoltaic capacity (installs per 10,000 households)	101.2	82.4	126.2	89.0	149.4	71.8	244.6	78.3	73.9	196.2	127.1
% Municipal Waste Recycled (2014)	35	40	34	33	32	37	60	35	55	52	48
% Households in fuel poverty (2013)	11.0	10.1	14.9	10.7	11.3	9.9	9.2	9.8	10.0	9.1	10.9

6.4 Analysing Trends

In comparing the performance of authorities, it is clear that differences in performance cannot wholly be explained by socio-demographic factors. All authorities have shown clear leadership in accelerating the deployment of particular low carbon technologies and programmes, such as Oldham on retrofit, Stockport and Wigan on Solar. For example, Salford's 'Greenwheels' project used operational transport policy changes to leverage wider change in employee and local perceptions of low carbon travel. Significant opportunities exist to spread the lessons learned and programmes used by leading authorities across Greater Manchester.

6.5 Reporting

This plan, in conjunction with the Greater Manchester Climate Change Strategy, comprises Greater Manchester's strategic Whole Place Plan for Climate Change and emissions reduction. In combination with Greater Manchester's Annual reports and linked emissions inventories, it is the basis of our compliance approach for Compact of Mayors, Integrated Covenant of Mayors and other external disclosure commitments.

7 SETTING FUTURE TARGETS - BEYOND 2020

Greater Manchester's Climate Change Strategy established a target to cut emissions by 48% between 1990 and 2020. Whilst a range of statements to commit to achieving at least 80% emissions reduction by 2050, and/or 2 tonnes per capita have been made in subsequent documents and as part of international commitments, any formal 2050 target is currently based on the national commitment to cut emissions by 80% by 2050.

7.1 International Commitments

Greater Manchester is a signatory to 3 International Commitments:



- Covenant of Mayors requires Greater Manchester to set targets aligned with or exceeding an 80% emissions reduction by 2050, and to achieve a 40% reduction between 2005 and 2030. (GM has delivered cc 26% between 1990 and 2013). The commitment also requires comprehensive action planning, monitoring and reporting using their specific methodologies. These are closely aligned to the Compact of Mayors requirements.*
- Compact of Mayors: This requires the submission of detailed information and reporting using the Carbon Disclosure Protocol, including emission reduction and energy decarbonisation action, aligned with the overall 80% by 2050 goal. In order to achieve 'compliant' status, data and reporting must be presented using the GPC greenhouse gas emissions reporting protocol.*
- Under 2 MOU requires cities to commit to achieving emissions reductions of at least 80% by 2050, and/or achieving a total emissions per capita of a maximum 2 tonnes per person by 2050. (GM's 2013 performance is 5.6 tonnes per capita). There are no specific reporting requirements, although this is a new commitment, so further requirements may be proposed over time.

*to be merged into one Global Covenant of Mayors

In addition, seven of GM's authorities have also committed to eliminating fossil fuels by 2050 as part of a 100% clean energy pledge. In March 2016, the GMCA made a firm commitment to setting a firm post-2020 target and establishing specific interim milestones; this has been included as a short-term action in this plan.

Key principles for the target were also established.

- The target should be science-based, and use a methodology which is compliant and compatible with the requirements of our international commitments;
- It should be globally ambitious, seeking to position Greater Manchester as a leader in delivering low carbon transition in a mature, western economy context;
- The target should be accompanied by a clear and transparent statement of the type and scale of measures which will be required to achieve it.
- As demonstrated in the EU's Pathways to 2050 analysis, 80% decarbonisation by 2050 actually requires decarbonisation at a rate of 100% for waste, 95% for road transport, power and buildings (including heat), 50% for air and sea transport, 40% for Industry and 20% for agriculture.

Greater Manchester plans to continue its work with the Tyndall Centre (UoM) to establish a robust target by Spring 2017. As part of this, we aim to be among the first cities to use tools developed for cities by the World Resources Institute, including:

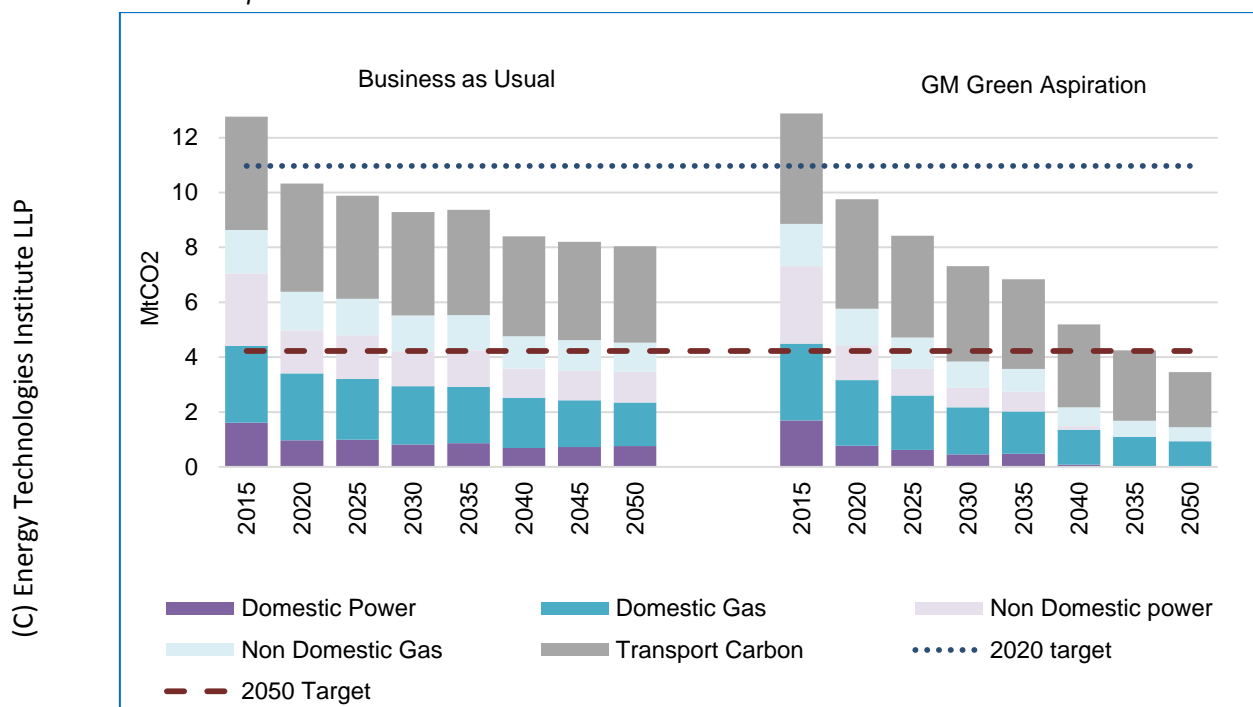
- an internationally developed 'Mitigation Goal Standard' tool which should enable evidence-based targets and milestones to be set,
- a 'Policy and Action Standard' which will enable Greater Manchester to more accurately forecast and track the impact of policy and project interventions, enabling more robust prioritisation.

The ability to more readily benchmark and compare our performance with world cities is a further advantage of using these international standards.

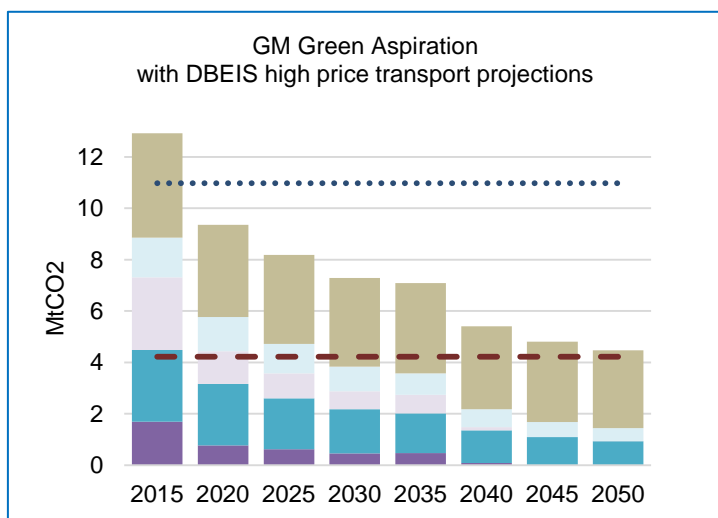
7.2 Setting a Pathway to 2050

The Energy Technology Institute (ETi), as part of the Smart Systems and Heat Programme, has worked with GMCA to prepare a high level forecast of the future carbon emissions of Greater Manchester, based on available data¹. By applying the National Grid Future Energy Scenario grid carbon projections, with appropriate consideration of other future projections from the ETi and DBEIS, and in combination collated GM data sets, future carbon projections have been developed under two alternative scenarios. The GM Green Aspiration scenario is considered the one most consistent with established policy and decarbonisation objectives. It should be noted there is evidence that greater decarbonisation of domestic and non-domestic gas could be needed to cost effectively meet national climate change targets. The Graphs below give the projected carbon emissions from each scenario.

1. Business as Usual
2. GM Green Aspiration



In the GM 'Business as Usual' scenario, the carbon emissions from transport have been taken from DBEISs transport carbon projections (DBEIS 2016). The reference scenario has been used as this represents the lowest carbon



reduction pathway. For the GM Green Aspiration scenario, the transport projections from the ETi ESME patchwork model have been used. This represents the best case carbon reduction path and will allow an understanding of the potential maximum reduction in emissions from transport.

The Green Aspiration scenario has emissions in 2050 at a level of 43% of the business as usual scenario and exceeds the target reductions.

In **GM Business as Usual** the 2020 target is reached, but the 2050 target is missed by 4MtCO₂. In 2050, the

¹These future energy scenarios are based on available information obtained and provided within the confines of the Energy Systems Catapult study as part of the ETi Smart Systems and Heat Programme. This has been informed by the National Grid Future Energy Scenarios and the other relevant data sources referenced.

project carbon emissions are 8MtCO₂ with 44% coming from the transport sector. The failure of the grid to decarbonise and a large amount of residual gas in the system means that the carbon from the building stock is slightly more than the carbon from transport, with 29% from the domestic sector and 27% from the non-domestic sector.

In the **GM Green Aspiration** scenario, the 2050 target is reached (3.4 MtCO₂ in 2050 compared to the 4.2MtCO₂ target), with the grid completely decarbonising and the residual gas demand reducing enough that the emissions remain close to the 2050 target despite significant emissions from the transport sector which make up 58% of all emission in 2050. The domestic sector, with 27%, is emitting almost double that of the non-domestic sector (14%).

Whilst there is little recent research at the city-region scale for Greater Manchester, the following (non-exhaustive) list aims to inform key stakeholders about the likely minimum level and impacts of intervention that would be required in order to deliver an ambitious 2050 target. All assume that behavioural change to more carbon efficient lifestyles will take place alongside the technological shifts shown below. Drawing on the scenarios outlined in the EU and DBEIS's Pathways to 2050 analysis and the Energy Technology Institutes' 'ESME' scenario model², a critical path for Greater Manchester could resemble the following:

Late 2010s	
Buildings & Heat	Development of fully compliant Planning, Housing and Transport Strategies and Plans;
	Deployment of first wave of new heat networks;
	Consider active use and enforcement of building regulations and landlord minimum standards;
Power	Development of a detailed energy opportunities investment pipeline;
	Accelerate deployment of PV and existing energy generation opportunities;
	Substantial business support to decarbonise and boost productivity;
Transport	Significant scale up of hybrid, ULEV and Electric vehicle deployment (e.g. 2015:1000, 2020: 40,000 registered vehicles).
Early 2020s	
Buildings & Heat	Significant roll out of heat networks, and penetration of heat networks into domestic properties;
	Net zero emissions from new build, both domestic and commercial;
	No new gas boilers being fitted in domestic properties;
Power	Mass deployment of demand response systems to reduce peak power demand and re-profile consumption to match cheap renewable supply;
	Penetration of time of use and flexible, local energy contracts linked to storage;
	Deployment of solar PV schemes on c30% of viable stock;
Waste	Significantly increased recycling rates, less waste production;
	Greater local use of RDF (refuse derived fuel);
Transport	Further electrification of public transport.
Mid 2020s	
Buildings & Heat	The retrofit or demolition and replacement of almost all hard to treat and inefficient building stock;
	Delivery of every proposed wind, hydro, heat network and biomass scheme identified as viable from a techno-economic perspective and increased deployment of energy storage.
Power	
By 2030	
Buildings & Heat	An almost total elimination of gas at home or building level, with a residual use of carbon-abated gas for heat networks;
Power	Mass deployment of solar PV on all suitable building stock;
Waste	A more circular economy, with significant local synergies between production, consumption and reuse of materials;
Transport	A shift in private car and other road vehicles used to over 50% penetration of electric and ULEV vehicles, with the remainder being ultra-low emission stock and no new fossil fuel vehicles being bought.
During the 2040s	
Buildings & Heat	Elimination of fossil fuels from peak, standby and general power generation from sources without carbon abatement;
Power	Elimination of fossil fuels from transition technologies including heat networks;
Transport	No remaining fossil fuel vehicles on the road (deminimis).

² <http://www.eti.co.uk/project/esme/>

8 WORKING TOGETHER

Greater Manchester has a long history of partnership working. The delivery and implementation of this Plan will only be achieved through all sectors working together. This approach will be sustained and improved by coordinated working through Greater Manchester’s Low Carbon Hub.

8.1 Greater Manchester Low Carbon Hub

The Low Carbon Hub was established by the first City Deal (2012) as a centre of expertise for achieving economic gain through the integrated delivery of carbon reduction programmes. The Hub aims to harnesses the knowledge of our universities with the innovation of our businesses and strong public governance of the Combined Authority.

Working in Partnership to Deliver a Low Carbon Future

Governance and oversight is provided by the GMCA and LEP. LA Leaders are assigned theme portfolios and Chief Executives are responsible for delivery.

Greater Manchester Combined Authority (GMCA) & Association of Greater Manchester Authorities (AGMA)

Local Enterprise Partnership (LEP) & Business Leadership Council

Six Thematic Boards comprising members from public, private, NGO, academic and third sectors oversee GM’s policy to delivery priorities

Transport	Skills & Employment	Growth & Reform
Planning & Housing	Low Carbon Hub	Health & Social Care

Accountable bodies translate priorities into policies, initiatives, projects and actions. Communities are directly engaged in many of the projects they deliver.

Low Carbon Project Development Unit (LCPDU)

New Economy (NE)

Skills & Employment Partnership (SEP)

GM Waste Disposal Authority (GMWDA)

Manchester Growth Company (MGC)

Transport for Greater Manchester (TfGM)

Task and finish and sub groups draw in further key stakeholders and experts to collectively progress the Climate Change Strategy’s themes. These include:

- Buildings
- Energy
- Transport
- Carbon Literacy
- Natural Capital
- Sustainable Production and Consumption.
- Skills and Sector Growth



Achieving our targets cannot be accomplished by GM authorities working in isolation. Attaining both our carbon and air quality targets require significant action and commitment to reduce emissions from the private and voluntary sectors, wider public sector and the general public. The Low Carbon Hub approach is to encourage and, where possible, support such action by bringing together key stakeholders to work collectively on these goals, utilizing a mixture of existing funding mechanisms to deliver local projects. In addition, stakeholders are encouraged to collectively bid for national and international funding to deliver projects and programmes which meet our aims.

This partnership approach has led to an increasing recognition that Greater Manchester is capable of setting the national agenda in key policy areas, and increasing devolution is providing significant opportunities to work with Government, particularly DBEIS, DfT and DEFRA, to secure additional funds, powers and opportunities to both deliver for Greater Manchester and inform and develop the national approach.

8.1 Networks and Pledges

Greater Manchester operates a 'Green Growth' Programme to engage business and organisations' stakeholders in delivering resource efficiency and becoming fit for a low carbon economy. **Green Growth Pledges** are a range of actions - from simple first steps to wholesale changes - that will reduce environmental impact and help organisations grow at the same time. Participants can choose from a number of different categories and build their expertise in each one. A Green Growth Pledge is a message to customers and the wider business and stakeholder community that action is being taken to become clean and green, reducing costs, increasing resilience, and leading the way for others to follow. (See Further Information for contacts)

The Low Carbon Network is a new and exciting opportunity to raise the profile of businesses in the low carbon and environmental goods and services sector and improve the visibility of local supply chains. The Network aims to enable companies to be better connected to new business opportunities and better informed about what is happening in their sector – from new tender opportunities to changes in government policy. It will also help build on our knowledge of the low carbon supply chain, thereby strengthening our support for local low carbon business (see 'Further Information' for contacts).

8.2 Learning from and with Others

As part of our commitment to tackling climate Change, we will work with the EU and international cities to share knowledge and experience, with the aim of accelerating the global transition to a low carbon economy.

Manchester is the first city to undertake to empower all its citizens with carbon literacy. Carbon literacy is the underpinning knowledge required to create a vital shift in how we live, work and study. The project is built on the principle that when we are carbon literate will have an instinctive understanding of the carbon impacts of our activities, and be able to make informed choices about the most energy and resource efficient and lowest carbon options available to us. This is a unique project driven by the fact that it is imperative that we all change the aspects of what we do that result in the generation of carbon dioxide and greenhouse gases. If we don't, then the scale of change demanded of us by nature in order to maintain a safe and healthy place to live, will simply not be achieved. Further information is available from www.carbonliteracy.com.

Technical Addendum:

In this plan, no account has been taken of the UK's vote, in June 2016, to leave the European Union, nor the implications this may have for future UK policy and funding for low carbon projects and programmes .

The majority of 2020 analyses used in this plan were based on 2013 Local Authority area datasets from DBEIS. The latest 2014 datasets have now been released and show Greater Manchester's carbon emissions have fallen from 15.3265mtCO₂ in 2013 to 13.550 mtCO₂ in 2014.

9 GLOSSARY AND FURTHER INFORMATION

9.1 Glossary

AGMA – Association of Greater Manchester Authorities	Gwork – Groundwork
ALMO – A council-linked social housing provider	H2020 – Horizon 2020 EU funding programme
BBP – Better Buildings Partnership	KPI – Key Priority Indicators
BGH – Business Growth Hub	LA – Local Authority
CHP – Combined Heat and Power	LCEGS – Low carbon Environment Goods and Services
CoT – City of Trees	LCH – Low Carbon Hub
DVSA – Driver Vehicle Standards Agency	LCPDU – Low Carbon Project Development Unit
DCLG – Department of Communities and Local Government	LED – Light Emitting Diode
DBEIS – Department Business, Energy & Industrial Strategy	LEP – Local Enterprise Partnership
EA – Environment Agency	MAG – Manchester Airport Group
ECO – Energy Company Obligation	MIDAS – Manchester’s Inward Investment Agency
ENWL- Electricity Northwest Ltd	MMU – Manchester Metropolitan University
ERDF – European Regional Development Funds	mtCO2 – Million tonnes Carbon Dioxide
ESC – Energy Systems Catapult	NCG – Natural Capital Group (GM’s Local Nature Partnership)
ETI – Energy Technology Institute	NEDO – New Energy Development Organisation (Japan)
EU – European Union	PV – Photovoltaic
FIT – Feed in Tariff	PSR – Public Sector Refrom
GM – Greater Manchester	RSL – Registered Social Landlord
GMENDG – Greater Manchester Energy Network Development Group	Salix – Government backed 0% finance for low carbon projects
GMEU – Greater Manchester Ecology Unit	SEP - Skills and Employment Partnership
GMCA – Greater Manchester Combined Authority	SMBC – Stockport Metropolitan Borough Council
GMLRF – Greater Manchester Local Resilience Forum	tCO2e – tonnes Carbon Dioxide equivalents
GMPH – Greater Manchester Public Health	TfGM – Transport for Greater Manchester
GMWDA – Greater Manchester Waste Disposal Authority	PV – Photovoltaic (cells)
HNDU – DBEIS Heat Network Development Unit	UKGBC – UK Green Building Council
	UoM: University of Manchester

9.2 Further Information:

Find out more about Greater Manchester’s Low Carbon Hub and how businesses, universities and the public sector are working together on carbon reduction and low carbon growth at: <http://www.gmlowcarbonhub.com> and www.greatermanchester-ca.gov.uk/info/20005/low_carbon

Contact Email and to Sign up to the Low Carbon Hub e-bulletin: lch@neweconomymanchester.com

Use our Twitter feed [@GMlowcarbonhub](https://twitter.com/GMlowcarbonhub)

On the Platform also provides you with a podium to share your thoughts, ideas and views on a sustainable future for Greater Manchester. There is an opportunity to develop articles and commentary directly and via the Low Carbon Hub team see <http://ontheplatform.org.uk/>

Links to Key Partners include:

Transport for Greater Manchester www.tfgm.com
Greater Manchester Waste Disposal Authority www.gmwda.gov.uk/

Useful resources for Businesses include:

Green Intelligence – tailored e-bulletin with green business news and case studies: www.greenintelligence.org.uk

Green Growth Programme – support for GM SME’s: www.green-growth.org.uk

Pledge – commit to a range of actions to help reduce environmental impacts: www.green-growth.org.uk/pledge

Twitter: [@enworks2001](https://twitter.com/enworks2001) [@BizGrowthhub](https://twitter.com/BizGrowthhub)

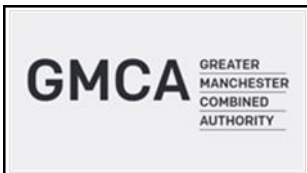
info@enworks.com 0161 237 4181

ANNEX A

The detailed emissions savings from each category (2014-2020) and assumptions made are shown below.

Technology	2013	2020	2014-2020 cumulative savings ktCO ₂	Comments
Renewable Electricity Generation				
PV	50.7 MW	226.0 MW	206.9	Capacity factor of 10.1% for Northwest in 2014
Wind	1.0 MW	3.3 MW	6.3	Scout Moor not included. Average capacity factor (2010-2014) for northwest- 26.5%
Hydro	0.9 MW	2.6 MW	4.6	Average capacity factor (2010-2014) for northwest- 27.8%
AD	13.4 MW	18.9 MW	34.8	Average capacity factor (2010-2014) for the UK- 60.2%
Sewage gas	15.7 MW	22.1 MW	37.5	Average capacity factor (2010-2014) for northwest- 55.2%
Landfill Gas	26.0 MW	34.8 MW	41.3	Average capacity factor (2010-2014) for northwest- 52.5%
Municipal Solid Waste	10.7 MW	15.1 MW	17.6	Average capacity factor (2010-2014) for the UK- 38.2%
Plant Biomass	3.8 MW	27.3 MW	91.5	Average capacity factor (2010-2014) for the UK- 52.9%. Barton Moss biomass plant (20 MW) operational beginning of 2019
Gas CHP		43.5 MW	62.1	Potential CHP deployment data by GMCA. Typical capacity factor of CHP-63%
Total Electricity			502.7	
Renewable Heat Generation				
Biomass	6.2 MW	140.9 MW	330.7	Current national deployment trends for GM from RHI database. Woodchip fuel replaces gas boiler
Solar thermal	0.02 MW	0.7 MW	0.5	Current national deployment trends for GM from RHI database. Heat replaces from gas boiler
GSHP	0.4 MW	7.0 MW	3.4	Current national deployment trends for GM from RHI database. Heat replaces from gas boiler
Biogas	0.1 MW	4.6 MW	2.6	Current national deployment trends for GM from RHI database. Heat replaces from gas boiler
ASHP	0.0 MW	7.8 MW	2.2	Current national deployment trends for GM from RHI database. Heat replaces from gas boiler
Gas CHP		43.5 MW	115.4	Potential CHP deployment data by GMCA. Typical capacity factor of CHP-63%
Total Heat			454.8	
University of Manchester			5.5	3 new CHPs by 2020. Emissions from Estates department
NEDO Project		600.0	3.6	600 HPs are installing by 2020. Replace heat from a gas boiler

Gas and Electricity grid network efficiency measures				
Smart meter (electricity)	9,900.0	1,182,000.0	102.7	All domestic properties will have smart meters by 2020. 2% savings per annum
Smart meter (gas)	6,600.0	1,086,000.0	81.1	All domestic properties will have smart meters by 2020. 1% savings per annum
Smart grid, ENWL		3%	311.6	Assuming network efficiency gains by 2% in 2018 increases to 3% by 2020 for GMCA
Total Network			495.5	
Buildings Efficiency measures				
Domestic retrofit EE		10,800.0	41.2	No of measures based on Toasty report by GMCA. Assumes 10,800 measures by 2020
Public			84.5	3% efficiency gains per annum for gas and 1% per annum for electricity for all public buildings
Commercial		-	-	Unknown
Total Efficiency			125.7	
Resource Efficiency Measures				
Public (Street lights)		228,730.0	117.6	Replacing 228,730 street lights with conventional lamps (average circuit capacity of 100 W) to LEDs (35W). 35% savings
Industry & commercial			125	Todd Holden (Pers. Com.)
Total Resource Efficiency			242.6	
Transport				
Fleet efficiency improvement (gCO2/km)	158.9	143.0	710.4	1.5% reduction in average car emissions per annum to 2020. Average vehicle km remains same
No. Of Ultra low emission vehicles	541.0	81,100.0	282.2	Current EV uptake rate towards 2020. EV mileage (kwh/km) and battery efficiency is based on Nissan Leaf
Metro expansion			42.1	Commuters switch 25% of their annual journey km to metro in 3 LAs. Total commuter figure from TFGM statistics.
LED Traffic lights		52,000.0	43.3	Siemens completed changing all 52,000 traffic lights to LEDs. (30% energy savings)
Total Transport			1078.1	
Carbon sequestration		3,000,000.0	14.4	3 million new trees (by 2030)
Total savings by GMCA			2922.8	



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Formally Published: October 2016.