GMCA GREATER MANCHESTER COMBINED AUTHORITY

GM Low Carbon Hub

Greater Manchester Climate Change and Low Emission Strategies

Joint Implementation Plan 2016-2020

Consultation Draft

FOREWORD

"The 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. 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 into a low carbon economy. This can only happen by being at the forefront of innovative action.

A significant amount has been achieved since the publication of our Climate Change Strategy in 2012; a firm foundation has been laid. This draft Implementation Plan builds on existing work and seeks to set out our priorities to 2020 and beyond. It includes actions to reduce our emissions to both address climate change and improve Greater Manchester's air quality. Our targets are challenging and cannot be achieved by Local Authorities working in isolation. 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 one pathway to our target, recognising that it is one of several possibilities.

The achievement of local carbon targets is significantly dependant on the delivery of national actions and resources, which will require co-operation with several government Departments. Devolution of additional powers and funding for the delivery of some of our low carbon investment ambitions is the subject of a Comprehensive Spending review bid to Government. In this consultation draft, we are seeking the views of our key partners, stakeholders and communities as to the strategic actions Greater Manchester needs to take to meet our targets and set the agenda for the next five years."

Cllr Sue Derbyshire
Leader Stockport MBC,
Chair of GM Low Carbon Hub

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1.0 INTRODUCTION: SHAPING THE FUTURE

Addressing the challenges and opportunities of climate change is one of the most significant issues of our time. In Greater Manchester, we must plan and act now to support global efforts to limit the potentially catastrophic impacts of a changing climate over the decades to come. Even now, the unavoidable local impacts of climate change include warmer, drier summers and warmer, wetter winters, leading to increased flood risk from rivers and surface runoff. In addition, anticipated increased temperatures, particularly in summer months, exacerbated by the urban heat island effect, will have subsequent impacts on our citizens, economy and ecosystems and increase the need for city cooling measures. More extreme weather patterns are also likely, with more intense rainstorms, heat waves and droughts. Without significant interventions to curb our carbon emissions now, the impacts will be worse, both locally and across the globe. The "Mini-Stern" review for Manchester concluded that the impact of unavoidable climate change on the Greater Manchester economy could be profound, with a potential loss of £20 billion to the economy to 2020 if we fail to adapt.

FACT: The temperature in England has already risen by more than 1^{o}C since the 1970s and 2006 was recorded as the warmest year for 348 years. In Copenhagen in 2009, the international community reached agreement to limit climate change to 2^{o}C above pre-industrial levels, beyond which point the risks would be `dangerous'.

Whilst climate change will have medium term impacts, poor air quality is having a real and significant effect on local people's lives now, 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. 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. As well as the human cost, there is an indirect impact on the economy as a whole: health problems affect the ability to work and contribute to low productivity. The 'National Air Quality Strategy' (DEFRA 2007) stated that poor air quality costs society between £8.5 billion and £20.2 billion a year.

This Implementation Plan describes the strategic actions Greater Manchester intends to take to deliver its Climate Change (2012) and Low Emissions (2015) Strategies between 2016 and 2020. Where possible, the plan quantifies the contribution of key interventions over the next five years which will enable us to achieve our climate change and low emission strategy objectives, contributing to the sustainable economic growth, environmental quality, climate resilience and well being of the city region. Whilst our 48% (from 1990) reduction target by 2020 is ambitious in itself, it is not enough for Greater Manchester just to deliver short term actions to meet this target. The UK's long term goal of a minimum 80% cut by 2050, and legally binding UK targets for cuts by 2030, mean that we will also need to plan and act now for the longer term (see Section 8) so we do not inadvertently lock ourselves in to a medium – emissions future, by only focusing on short term gains.

The plan particularly highlights those interventions required to create a step-change in our activities, rather than list those activities which are now considered `business as usual' by Greater Manchester partners. Subject to consultation, the plan will be adopted by the Greater Manchester Combined Authority (GMCA) and particularly reflects the Combined Authority's commitments. It also recognises that our goals cannot be achieved by the GMCA working alone. It builds on research undertaken to define a likely pathway to achieve our carbon reduction and air quality targets and describes one path from several possibilities. Where feasible, we have attempted to quantify and cost identified measures.

To be successful, this pathway does rely on the willingness of organisations, businesses and individuals in Greater Manchester to play their part and undertake their own step change activities. Where possible, it sets out how the Combined Authority can support others to take action and also details some of Greater Manchester's key achievements from the last three years (see Page 11). A summary of the Plan is provided on page 12.

2.0 THE STRATEGY: OUR OBJECTIVES AND TARGETS

This Implementation Plan aims to achieve the objectives set out in the Greater Manchester Climate Change Strategy (2012) and Low Emission Strategy Action Plan (2015).

Greater Manchester's Climate Change and Air Quality Outcomes by 2020 include:

1. **We will make a rapid transition to a sustainable low carbon economy**
2. **Our collective carbon emissions will have been reduced by 48%**
3. **We will be prepared for and actively adapting to a rapidly changing climate**
4. **Low emission behaviours will have become embedded into the culture of our organizations and lifestyles**
5. **We will support the UK Government in meeting all EU thresholds for key air pollutants at the earliest date to reduce ill-health in Greater Manchester**

By 2020, using 1990 as a baseline, Greater Manchester is committed to a 48% carbon emission reduction target as part of the Greater Manchester Strategy (2011) and has reiterated this target in a number of subsequent plans. Although there is currently no statutory financial penalty for failure to meet the carbon reduction target, there is a significant opportunity cost in energy savings. Recent data suggests that achieving the 48% carbon target would, in 2020, prevent an estimated £1bn per annum from leaving the GM economy in direct energy costs alone. In addition, Greater Manchester's households, organisations and businesses pay between £100-200 million per year in energy related taxes, levies and charges.

The European Ambient Air Quality Directive (2008/50/EC) sets legally binding limits for key pollutants in the air we breathe outdoors. The EU must meet these limit values by 2020 and the UK Government has therefore set national standards which local authorities must work to achieve. Local Authorities therefore have a statutory duty, under the provisions of the Environment Act 1995, the National Air Quality Strategy 2000 and Air Quality Regulations, to review and assess air quality against these standards (See Annex 1).

2.1 A CHANGING CONTEXT

The previous Climate Change Implementation Plan (2012-2015) has been delivered against a backdrop of significant change. 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 was established to integrate 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 in these areas.

FACT Sector: In 2012, 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 £5.4billion, showing annual growth of around 4% with particular growth in the renewable energy sector at 5.6%.

A new style of local government has brought together Greater Manchester's 10 local authorities to become the UK's first Combined Authority. Against the backdrop of a referendum on Scottish independence, new powers were negotiated to enable Greater Manchester to have greater control of health, transport housing and planning decision-making and budgets. With greater control and certainty over budgets comes the enhanced ability to deliver greater impacts, including a low carbon economic transition e.g. enhanced responsibility for local transport and a £300m housing investment fund for an additional 15,000 new properties over a 10 year period.

Devolved planning freedoms have seen Greater Manchester agree to develop a Spatial Framework as a statutory joint Development Plan, 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, spatial planning to link future homes to employment opportunities and addressing the impacts of elevated temperatures and flood risks on critical infrastructure.

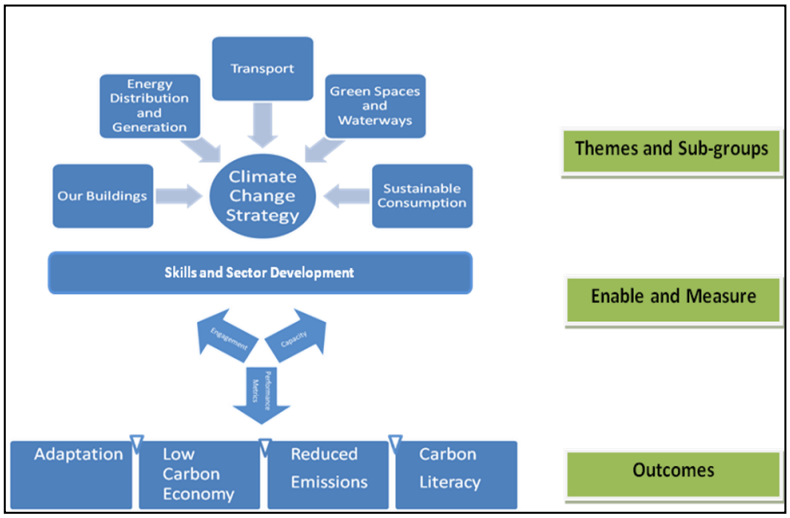
Inefficient energy use and slow deployment of renewable heat/power adversely affects Greater Manchester's economy; damaging business productivity and personal prosperity, directly causing poverty. From a low carbon perspective, while the commercial sector continued to decarbonise and access low carbon 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 the first signs of electrification of rail and car travel have been offset by increased demand for private car journeys. Successive changes to financial incentives and framework for low carbon generation and perceived public disaffection with current the 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.

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 economy. Such a transition requires decreasing fossil fuel consumption, improving system-wide energy efficiency and increasing renewable energy generation.

2.2 OUR DELIVERY APPROACH

Our delivery approach was clearly set out in the Greater Manchester Climate Change Strategy (2012). The Strategy describes 5 Themes (see Fig 1), each with its own carbon reduction and climate change adaptation potential, which are devised to realise our four outcomes. In addition, GM seeks to establish economic benefits from the low emission transition through sectoral growth and skills development.

Fig. 1 – GM Climate Change Strategy Themes



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.

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.

Achieving our targets cannot be accomplished by GM authorities working in isolation. Attaining both our carbon and air quality targets requires 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.

3.0 THE SCALE OF THE CHALLENGE: CARBON WEDGE APPROACH

It is recognised that there is no single `silver bullet' which will reduce emissions sufficiently; it will require a portfolio of action and choices across all aspects of society, with each reducing emissions against a business as usual scenario. As the future is unpredictable, for this plan we have defined one pathway to our target, recognising that it is one of several possibilities.

This *Carbon Wedges* approach was originally developed by Princeton University as a way of communicating this concept. By adding individual `wedges' of carbon reduction measures together, it creates "one" possible pathway to the target. As GM moves down this pathway, some of the wedges will become easier, some will become harder, and new ones will materialise. Periodically reviewing the wedges ensures that the most cost effective pathway is "the" pathway which is ultimately taken.

The 20 years following the 1990 baseline saw our absolute emissions drop from 21.1mt CO_2e to 16.5mt CO_2e in Greater Manchester. This was possible, in part, due to a number of one off `wedges' which cannot be readily replicated, including:

- a move from coal to gas for electricity generation reducing the carbon intensity of electricity,
- improvements in vehicle technology kept emissions the same despite an increase in demand
- a shift to a knowledge economy reducing industrial emission by 46%

FACT Energy: Total fuel consumption in GM in 2011 was 4,531kte of fuel. The majority of energy used in GM is gas which is used both in the domestic and industrial sector, followed by petroleum products. This pattern is broadly similar to the UK, however GM uses a slightly larger percentage of gas and a slightly lower percentage of petroleum products.

While Greater Manchester's underlying emissions have fallen, there are year on year variations which are the result of key variables, namely:

- the way electricity is generated (more coal, more carbon)
- the weather especially in spring/autumn (homes and buildings heated for longer)
- the type and level of economic activity (heavy industry is more carbon intensive)
- the population and number of households (more people, more carbon produced)

Whilst it is important to view emissions in light of these variables to understand the impact of the wedges and the underlying progress being made, GMs 48% target (i.e. 11mt by 2020) is an absolute figure reflecting the physics of climate change. The 16.15mt (emissions in 2012) can be broken down by fuel type and use as follows:

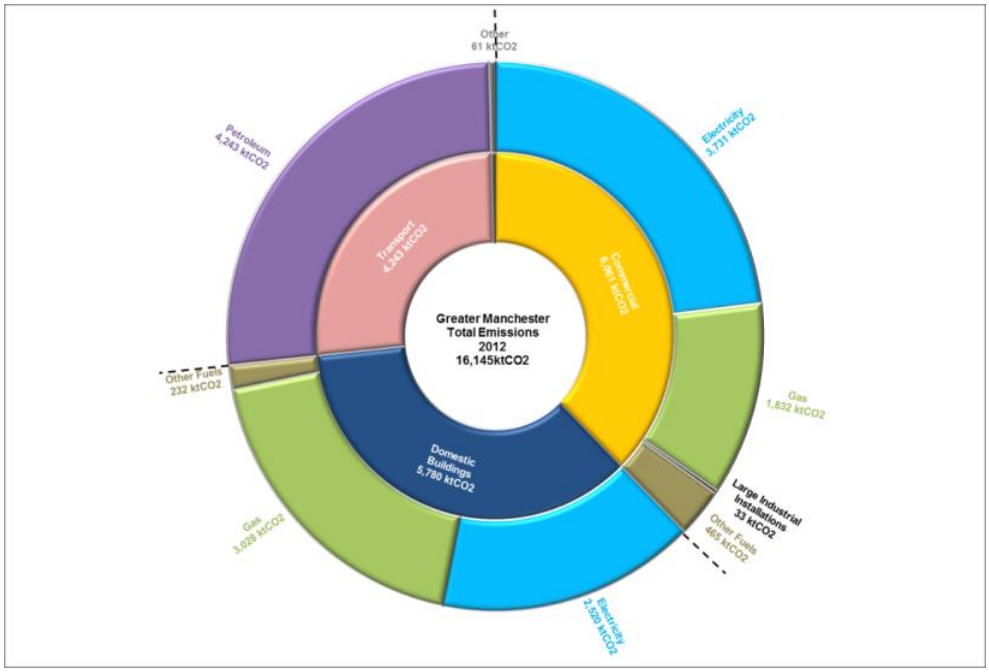


Fig 2. Greater Manchester Carbon Emissions by Source and Fuel Type and use

So, over the period 2013-2020 emissions need to fall 5.15mt from 16.15mt to 11mt CO_2e, over the 7 year period. These reductions can be grouped into one of four categories:

- **National action** e.g. Building Regulations, Fiscal Instruments
- **National action with local influence** e.g. Micro renewables and Green Deal retrofit
- **Local Authority sector** – funded and proposed e.g. public estate, structural funds
- **Business, Wider Public sector and Individuals** – unidentified actions e.g. individual choices, travel, building energy efficiency

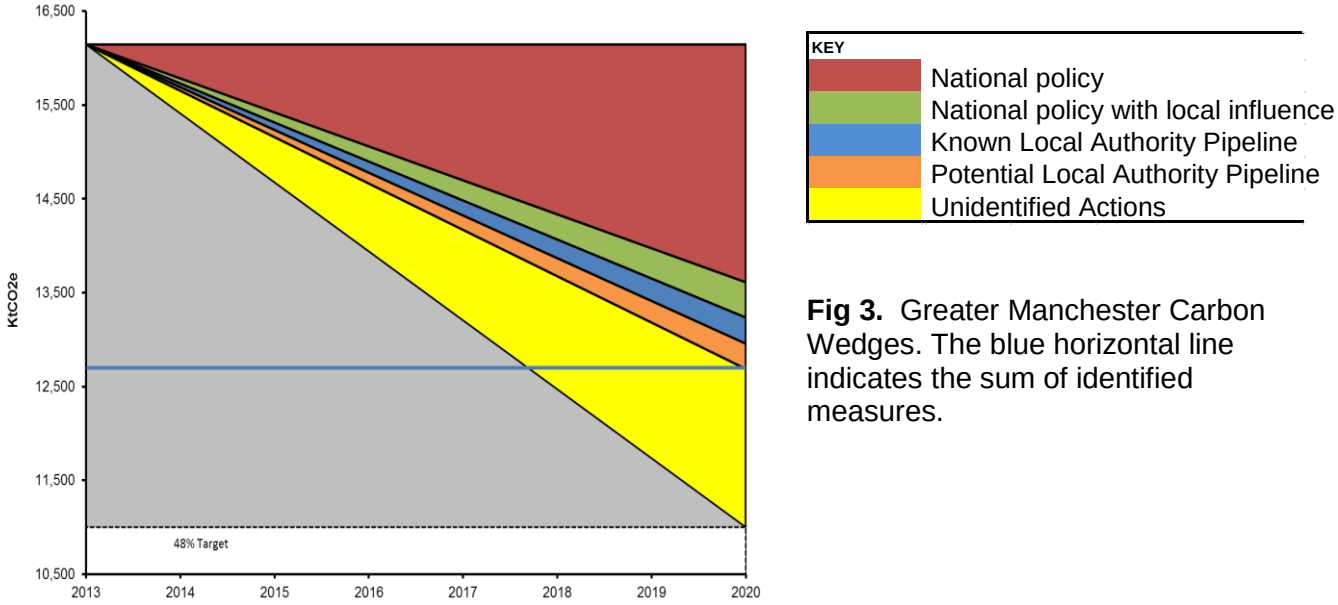


Fig 3. Greater Manchester Carbon Wedges. The blue horizontal line indicates the sum of identified measures.

There are numerous pathways as to how the GM target can be achieved; Fig 3 identifies the likely relative proportions of contributing wedges at a given point in time. By reviewing current Government Policy, it is possible to determine the levels of carbon savings which should be delivered if National action achieves its targets and GM gets a proportionate share of the benefits, including through local adoption and influence. The rest needs to be achieved through local action, see Fig 4.

Fig 4: GM Carbon Reductions (displayed graphically in Fig.3)

GM Carbon Reductions to 2020	Carbon Emissions (tCO_2e)	
Reduction required to meet 48% (from 2012)	5.15m	
National policy will deliver	2.54m	2.91m
National policy (with local influence)*	0.38m	
Local Initiatives need to deliver	2.24m	
Estimated impact of existing projects**	0.28m	2.24m
Estimated Impact of potential pipeline	0.27m	
Estimated Unidentified actions	1.68m	

* Includes projects driven by national policy that require local delivery to accelerate deployment
** includes those which are being delivered or actively being developed by LCPDU and can be delivered by 2020 (these are not all currently fully resourced)

The existing (0.28m) and potential (0.27m) local projects, which form our `local' wedge, were originally identified through the Wedges consultancy report produced for the Environmental Sustainability Technical Assistance project and a similar study from TfGM. They have since been revised and refreshed in consultation with relevant senior officers and are current as of December 2014 (see Fig. 5). Additional emission reductions will have occurred between 2013-2015, the results of which will only be known when the data is published (18 months in arrears).

FACT Fuel Poverty: Nearly 11 percent (in 2013) of Greater Manchester households are in fuel poverty (required fuel costs above the national median level which, if they were to be spent, would leave residual income below the official poverty line). The national average across England is 10.4%

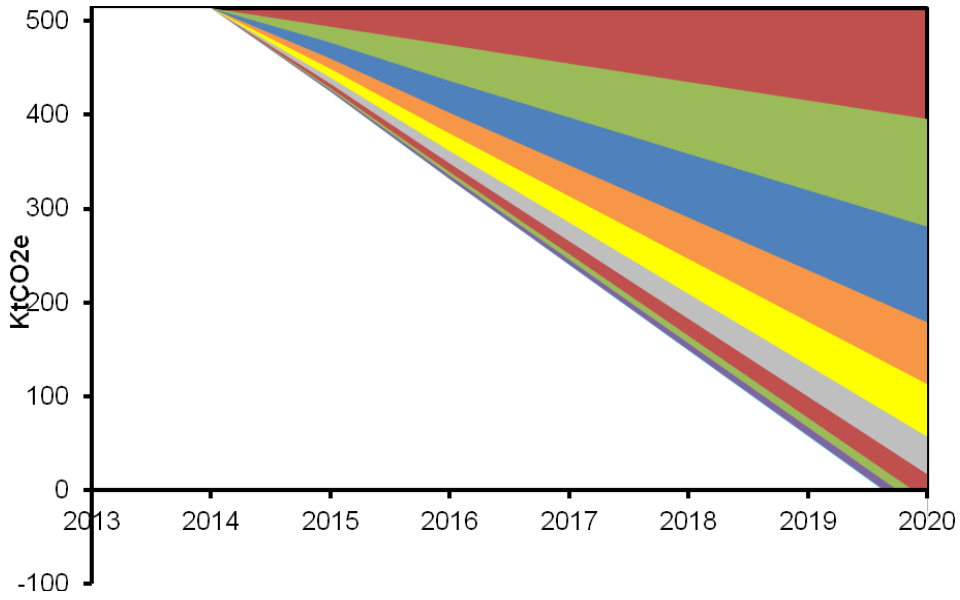


Fig.5 Existing (0.28m) and Planned (0.27m) Local Authority Pipeline

KEY	
	Commercial Resource Efficiency
	Heat Networks
	Transport Choices
	NDEE
	Domestic retrofit
	Wind
	Cycling Infrastructure
	Public Transport
	Energy from Waste
	PV

Unidentified Actions

The current `unidentified action' wedge of 1.68mtCO2e (See Fig. 3) broadly reflects the proportion of activity that is needed and could reasonably be expected to be brought forward by the local wider public, private and voluntary sectors as their contribution to local targets over the period. These measures might include emissions reduction from both resource efficiency and clean energy generation projects e.g. travel choices, commercial building retrofit and local energy generation.

GM can achieve a 48% carbon reduction target by 2020, however this will require:

- **Delivery** of the existing identified GM project pipeline and the delivery of a significant extended pipeline of Local Authority lead energy efficiency and energy generation projects
- **influencing** national policy and local delivery of national policies; and
- **encouraging** local non-Local Authority led projects.

FACT: Electricity: The majority of electricity used in GM is from large scale energy generation located outside of GM's borders. Up to December 2013, there had been 13,993 micro generation installations within Greater Manchester, across all districts. Micro generation within GM is 45,666KW, of this 99% is produced by photovoltaics. Some authorities have achieved much more rapid rates of deployment than others.

The interventions within this plan reflect those required to be taken by GMCA and our partners in each of these areas. They are prioritised on the benefits they bring to reduce our emissions and create a route map to deliver our 48% carbon reduction target and air quality improvements by 2020.

Significant additional resource will be required to deliver the full 48% target and fill the current gap (1.68 mtCO2e).

4.0 FUNDING

Investment Required

The question of how much we need to invest to achieve our objectives is a difficult one to answer as it will largely be driven by national policy (accounts for 56% of the GM target) and funding and Greater Manchester's ability to maximize the impact of this locally. If national government were to underperform their targets, the local contribution to the target would need to increase. In addition, the pathway selected may require some political decisions on options to be taken. Each option may have a different cost to achieve a similar carbon reduction.

To meet our stringent targets we need to prioritise investment in the actions and polices that will have the greatest impact, both in the long and short term. The carbon wedges approach, if used iteratively, provides us with a tool to ensure the pathway we chose is the most cost effective. The pathway selected will therefore also be informed by the availability of local, national and international funds. AGMA provides revenue funding to support small teams of officers to focus on environment, planning and low carbon investment as well as funding for TfGM and GMWDA to develop the city regions transport and waste infrastructure respectively.

European Funding

In April 2013, Greater Manchester was awarded €415m for the 2014-2020 EU programme, split evenly between European Regional Development Fund and European Social Fund. To secure this allocation GM was asked to draft an Investment Plan setting out our priorities over the next seven years. The Greater Manchester EU Investment Plan has identified the following Strategic Priorities in relation to Low Carbon:

1. Drive a Low Carbon Economy via development of energy enterprises
2. Develop GM's whole place low carbon infrastructure to deliver resilient/well adapted places to support the low carbon transition
3. Develop and demonstrate whole building energy efficiency/low carbon energy generation
4. Support growth in GM's SMEs in the low carbon/environment sector
5. Support SMEs across all sectors to increase the energy/resource efficiency of their business
6. Ensure appropriate low carbon skills to support the development of the sector and the transition to a low carbon economy

In addition, EU non-structural funds can play an important role in funding priority capital and revenue projects. Based on alignment with GM priorities and size of budgets it is proposed that our focus should be on the following programmes:

- Northwest Europe Interreg VB (2014-2020) has allocated EUR147m to the Low Carbon Priority and EUR 95m to Resource Efficiency Projects.
- Atlantic Area Interreg VB (2014-2020) has allocated EUR 29.7m to the Resource Efficiency Priority, and EUR 39.5m to Biodiversity, Natural and Cultural assets.
- Horizon 2020, the EUR78bn EU framework programme for research and innovation (2014-2020) includes a strong focus on societal challenges including energy, climate change and the protection of the environment.
- LIFE is the EU's funding Programme supporting environmental, nature conservation and climate change projects. The total budget for funding projects during 2014-17 amounts to EUR 1.1bn for Environment and EUR 0.36bn for Climate Action.

EU Funding calls are highly competitive, nevertheless we believe that by having a coordinated approach to EU Funding, GM will maximise the chances of succeeding on EU bids attracting extra EU funding to deliver our strategies. Being more proactive at EU level will also enhance our reputation in the UK and Europe, bringing together partners to support projects that will drive our economy and will help to deliver the GM Low Carbon Hub priorities. Better integration of national funds, e.g. from taxes and levies, at a local programme level would enable much greater leverage of European funds and private sector match. Significant economies of scale and wider socio-economic benefits may be achieved by enabling joined-up procurement and local area roll out.

National Funding

Funding for the delivery of our low carbon investment ambitions are the subject of a Comprehensive Spending Review (CSR) bid to Government. In our CSR proposals, we propose that Government devolve deployment of an escalating proportion of low carbon delivery funds at a rate which matches the city region's primary energy consumption. We would use these funds to develop and deploy local carbon reduction and energy security infrastructure incentives and initiatives.

If agreed, to deliver this programme, Greater Manchester proposes to create a private sector led, private-public partnership with executive powers, "Energy for Greater Manchester" (working title). A fully developed independent municipal energy company could, through its' trusted local brand:

- Provide compelling competition to existing suppliers in the energy market;
- generate revenue surpluses/savings;
- reduce energy costs to the fuel poor;
- encourage the development of low carbon/renewable generation by offering power purchase agreements; and
- support and encourage the achievement of GM's socio-economic and low carbon goals.

Such an approach would be demonstrably beneficial, as it would support and enable significant acceleration of investment in local low carbon infrastructure to support growth across GM. Through an enhanced ability to plan successive actions, the full economic benefit of energy efficiency investment and its role in delivering high levels of economic growth and jobs may be achieved. It would also permit the integration of existing national funding streams to enable a medium term planned programme of cross-cutting delivery across the key drivers of Greater Manchester's growth trajectory, utilising locally relevant research and action. Greater certainty of funding would, in turn, allow far greater leverage of ERDF, European and private sector match funding and international bond finance schemes to secure re-investable returns, as well as local business and community infrastructure levies.

An example of the enhanced impact of existing local delivery of national schemes can be seen in the disproportionately high uptake of ECO; Greater Manchester has 7.7% uptake of the UK share (a 20-30% uplift), as a result of local authority promotion and intervention.

5.0 PROGRESS TO DATE - ACHIEVEMENTS ACROSS GREATER MANCHESTER

Since the publication for the GM Climate Change Strategy in 2012, a significant number of achievements have been made:

Delivering a range of low carbon projects

- £6m Green Deal Communities Programme, `Little Bill campaign', delivering solid wall insulation
- £10m+ ECO funding through commercial partners, assisting fuel poor residents (Ann saving 4.2 $KtCO_2$)
- £30m Air Source Heat Pump demonstrator programme with NEDO (Japanese Government)
- 57000 people engaged on Energy Switching and £0.6m invested in fuel poverty
- £3m Business Resource Efficiency & Sector Development Programme
- Electric Vehicle Charging Scheme, Metrolink extension, `Ticket to Kyoto', £20m Velocity, introduction of electric and hybrid buses
- Opening of four combined Anaerobic Digestion facilities (1.875 MW) plus a new energy from waste CHP plant at Runcorn (30MWe (electrical) and 51 MWth (thermal)

Developed a future pipeline of climate change and low carbon projects

- £2.7m Elena funding secured to provide project development unit capacity (LCPDU) focusing on heat networks and street-lighting conversion to LED,
- Heat map of GM produced, scoping work for onshore wind undertaken
- 1 heat network at procurement stage, 3 in feasibility study and 7 more at master-planning stage
- An Energy Company/Enterprise concept, as an investment vehicle for low carbon infrastructure, is being investigated
- A number of EU funding bids have been developed for delivery in 2015 onwards if successful
- Financial models for energy efficiency in public buildings developed & procurement mechanisms assessed
- Secured resources to implement IBM/AECOM's 'Disaster Resilience Scorecard' for GM
- Secured £1.4m investment in a £3.7m local Nature Improvement Area from Heritage Lottery Fund
- GM is a €1m full partner in the H2020 Climate Resilient Cities project to support planners and decision makers in increasing our climate resilience over next 3 years

Governance

- Low Carbon Hub established as centre of expertise
- First Climate Change Implementation Plan jointly produced with DECC
- GM Energy Plan, Fuel Poverty Strategy and draft Retrofit Strategy produced
- Two Memoranda of Understanding (MoU) developed with Government Departments
- Improved communications, bid writing and partnership working
- Research programme defined and being delivered (e.g. energy procurement)
- Signed the 'EU Mayors Adapt' and UN `Mayors Compact' commitments, plus one of only 45 global 'role model' cities to sign the UNISDR's 'Resilient Cities: My City is getting ready' campaign

Since 2005, GM has been able to use `bottom up' emissions data from DECC to accurately track its annual emissions (Figure 6). The last accurate data saw annual emission in 2012 increase by 1.2mt to 16.15mt, in part due to increased gas usage for heating (cold weather) and 0.4mt due to carbon intensity of electricity (shift back to coal).

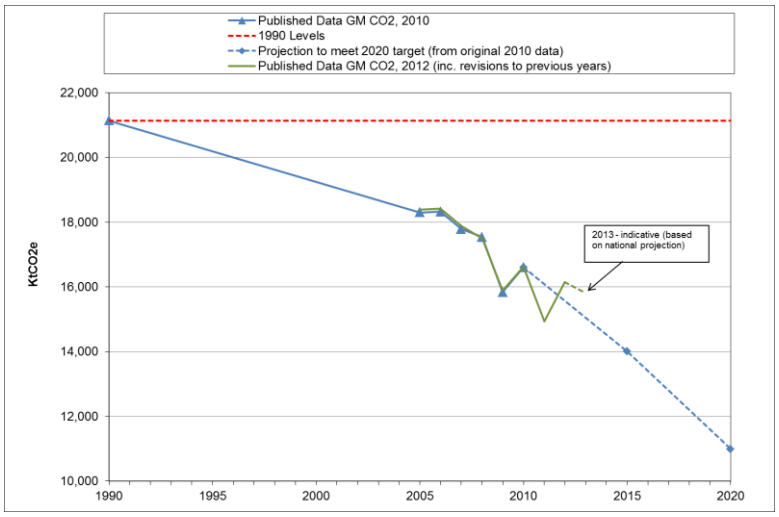


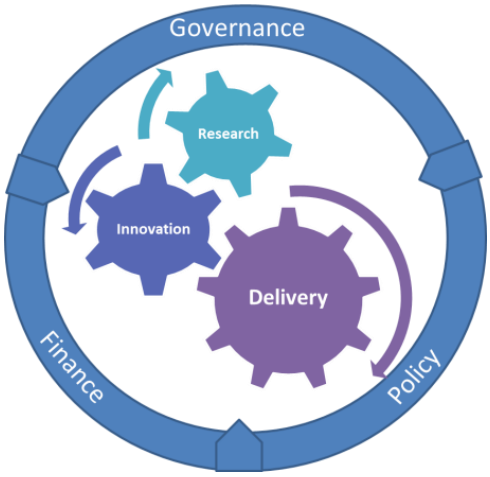
Fig 6. Greater Manchester Carbon Emissions against Target

Data source is National ONS, disaggregated for GM. 2013 data is provisional.

6.0 THE IMPLEMENTATION PLAN – IN SUMMARY

In summary, this plan sets out our intention to undertake:

Delivery:



- ❖ Identify and deliver the practical projects, actions and major schemes to:
  - achieve sustainable reductions in our carbon and other emissions in the near term,
  - grow our low carbon economy and
  - protect Greater Manchester from the consequences of an already changing climate.
- ❖ Delivery actions include significant potential programme of capital investments in:
  - heat networks and smart heat and power,
  - public transport infrastructure and street lighting,
  - low carbon energy generation and encouraging community schemes
  - Domestic and non domestic energy efficiency and demand response in buildings
- ❖ Encouraging private sector, wider public sector and communities to invest in low carbon energy efficiency and generation and influence businesses and the wider general public to conserve resources through wider business resource efficiency support and wider carbon literacy roll-out.

Research and Innovation:

- ❖ Develop our evidence base further and agree objectives and targets for the period 2020- 2035
- ❖ Undertake non-commercial research, development and demonstration projects to inform policy and ensure we have the products, technologies and services we need to decarbonise and increase the resilience of our economy
- ❖ The Wedges analysis highlighted areas of energy generation which require further feasibility assessment to better understand the future opportunity particularly in:
  - commercial wind, Photovoltaics, Energy from waste and geothermal heat
- ❖ Develop and implement innovative mechanisms to balance local energy procurement with local generation to yield value for money for local stakeholders and accelerate the deployment of low carbon infrastructure.

Governance, Policy and Finance:

- ❖ Implement a £300-500million programme of carbon reduction, low emission and resilience projects across GM, using £50m of ERDF and technical assistance funding plus identified EU transnational and UK funds.
- ❖ Influence policy development and integrate low emissions priorities into major GM health, transport, housing and investment programmes
- ❖ Work with central government to meet grid decarbonisation targets and have greater determination of national climate change taxes and levies to deploy locally to deliver greater efficiencies and value for money.
- ❖ Establish an underpinning spatial, economic and social policy framework to support the delivery of long term resilience and emission cuts, producing an energy master-plan for GM to underpin the framework by 2018.
- ❖ Develop and implement investment criteria for major assets and investments to ensure they are fit for 2050.
- ❖ Launch and implement the GM Low Carbon Investment Fund to catalyse private investment in low emissions infrastructure and develop financial instruments, incentives and services to deliver post 2020 activities
- ❖ If agreed, establish an energy retail and supply company, ESCOs and a national procurement service for heat networks, subject to feasibility
- ❖ Identify GM's carbon emission reduction and climate adaptation targets and priorities for the longer term

The resulting actions from the Low Carbon Wedges analysis form the basis of this Implementation Plan and can be summarised as follows:

Existing Pipeline Delivery*	**Extended Pipeline Delivery***	**Influencing Policy**	**Encouraging Wider Activities**
Deliver identified LA led Photovoltaics (2 $KtCO_2e$)	Extended LA led investment in PV (tbc KtCO2e)	GM - Consider potential to establish a municipal energy company and supplier licence	Encourage private and public sector PV installation.
Deliver identified Heat Networks/EfW (72 $KtCO_2e$)	Expanded Heat Networks/EfW and further feasibility (53 KtCO2e)	DECC – to meet UK grid decarbonisation targets	Accelerate delivery of National Grid Innovation Fund
Complete LA lead wind feasibility studies	LA lead investment in viable commercial wind (40 KtCO2e)	DECC – to support Urban Community Renewables (eg micro hydro, PV, wind)	Ability to support private sector commercial wind developments
Domestic Retrofit (Green Deal/NEDO) (41 $KtCO_2e$)	Continued investment in domestic retrofit (15 KtCO2e)	DECC - Greater local determination of national funds for heat and domestic energy efficiency	Further work to encourage energy efficiency/smart heat in social homes – share best practice
Energy Efficiency in Public Buildings – schools (13 $KtCO_2e$)	Extend to energy efficiency in identified LA buildings (53 KtCO2e)	DCLG - Flexibility to set local standards to encourage high energy performance measures	Energy efficiency in wider public and private sector buildings
Resource efficiency in Business (10 $KtCO_2e$)	Double the existing business support for resource efficiency (108 KtCO2e)		Carbon literacy, awareness raising and behaviour change initiatives
Public Transport Improvements (12 KtCO2e)	Tba as per the Low Emissions Strategy	DfT - Demonstrate the potential for hydrogen energy	Accelerated deployment of electric vehicles, potential for low emission zones
Smarter Travel Choices (102 KtCO2e)	Tba as per the Low Emissions Strategy	Tba as per the Low Emissions Strategy	Increased home working
Cycle Infrastructure (27 KtCO2e)	Tba as per the Low Emissions Strategy	Tba as per the Low Emissions Strategy	Increased efficient driver training

* Estimated savings (as at December 2014) from the Low Carbon Wedges analysis – the existing and potential extended pipeline continually evolves over time.

Key – Implementation Tables

The full results of the carbon wedges work can be seen in Annex 2. Where possible, the analysis identified the scale and effectiveness of the carbon savings that are technically feasible by 2020, as well as the savings identified in the current Local Authority pipeline and potential extended pipeline. We have used this information to inform the potential "carbon savings" ranking.

Impacts from the actions are wider than just emissions reductions and not all can be quantified. Abbreviations of lead organisations and partners plus definitions for the identified `Impacts' are provided in Section 9.0

In addition, each action in the following tables has been identified as either being "delivery", "influencing" or "encouraging" to align with the categories above. We have also attempted to identify the funding potential for each action. Finally, each commitment in this implementation plan has been identified based on this analysis and described as one of the following: Start Action (SA); Continue Action (CA); Further Opportunity (FO) or Further Investigation (FI). These categories reflect the state or readiness of each of the identified actions to deliver impacts, particularly carbon savings.

6.1 IMPLEMENTATION: BUILDINGS

The majority of the current building stock will still be in use by 2050. Energy used in domestic buildings accounts for 35% of the direct CO_2 emissions across Greater Manchester; and energy used in commercial and industrial properties, including over 2,000 operated by the public sector, account for a further 38%, highlighting the importance of building-level actions to this plan.

Until 2012, large scale deployment of retrofit could be seen in social housing, households in receipt of benefits, and from homeowners taking advantage of free insulation offers. The last 3 years have seen a substantial slow down in the amount of housing retrofit for some tenures as remaining properties tend to be harder and more expensive to treat and subsidies and incentives have changed and reduced. These market changes mean a new approach to delivering domestic energy efficiency is required. Enhanced social housing programmes and major private sector stock initiatives will be needed which half the energy loss from homes by 2050. In addition, if new development is not driven to appropriate low carbon design it will add to the existing stock levels that will have to be dealt with by more expensive retrofit measures.

Inefficient building stock can significantly add to the running costs of the business. A mismatch between property ownership and occupancy models and the fiscal incentives to drive energy efficiency, has become a barrier to the design and refurbishment standards which require longer term payback periods.

Significant opportunities still exist within the public estate to adopt good practice retrofit and building energy management already proven in the commercial sector. They provide an opportunity to explore 'aggregated' energy performance contracting models and will also play an important part in addressing this challenge by helping to 'lead the way'.

Key achievements

- Since 2011/12 GM partners have installed over **27,000** retrofit measures in **private sector homes, s**aving an estimated total of **15,000** tonnes of carbon per annum.
- An further estimated **50,000** tonnes of CO_2 saved per annum via 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
- **Non Domestic Energy Efficiency:**
  - Baseline data 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 an MoU with Salix Finance to provide at least £10M of 0% finance over three years for GM low carbon demonstrators.
  - 2015/16 will bring the potential to invest £3m in the 1st wave of schools retrofit programmes and a circa £1m RE:FIT corporate buildings programme, saving in excess of 10k tCO2e across the two demonstrators

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 was developed providing 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 are forecast to be completed on over 50 buildings by the end of the 2015.

FUTURE PRIORITIES

2020 Vision: To 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. 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:

- a framework to support value for money building retrofit activity
- energy efficiency and smart heating in social and private housing
- energy efficiency and smart heating in public buildings
- energy efficiency and smart heating in commercial buildings; and
- reduce emissions from new developments

GM will achieve this by delivering the following actions:

Commitment	Lead and partners	Impact (see Sec 9.0)	Action Type	Carbon Savings	Funding Potential	Local Action
Create a framework to support value for money building retrofit activity: • Lobby government for greater local determination of national funds for heat and domestic energy efficiency	**GMCA**, DECC	I	CA	NA	Local revenue secured	Influence
• Develop a clear financial and policy framework to accelerate and increase low carbon opportunities being realised in new build and refurbishment activities	**GMCA,** DCLG	I, B3	SA	High post 2020	Local revenue secured	Encourage
• Develop costing methodologies and investigate the potential for GM financial instruments (e.g. green bonds) to provide leverage for commercial property retrofit activity, and related infrastructure investment	GMCA, DCLG, DECC	I, B1	FI	High post 2020	Local revenue secured	Encourage
Deliver energy efficiency and smart heating in social and private housing: • Deliver current pilot of heat pump installation in social homes, supporting tenants with the change	**RSLs, Private Owners**, NEDO, ETI (SSH), DECC, Innovate UK	R, £	CA	Low	Local National Inter-national secured	Delivery
• Extend pilot to deploy a wider demonstration programme of integrated heat pumps, heat networks and demand aggregation in domestic dwellings and provide a financially viable offer to private landlords and owners.		R, £	FO	low by 2020 low-high post 2020	Local National **EU & ERDF** not secured	Influence and delivery
• Complete existing and support the delivery of future national domestic energy efficiency programmes e.g. Green Deal & ECO framework	**GMCA** 10 x LAs and GD partners	R, I	FO	Med by 2020 High post 2020	National Secured for current	Delivery & Influence
Deliver energy efficiency and smart heating in public buildings: • Develop and deliver a programme of energy efficiency in Local Authority owned buildings, • Work with partners on similar programmes in schools and other public sector estates.	**LCPDU** LAs, SALIX finance, local partners	R	CA CA	Potential High	Local and national Part secured	Delivery Delivery & Encourage
Deliver energy efficiency and smart heating in commercial buildings: • Engage with and facilitate work with commercial building owners and major occupiers to encourage commercial building retrofit e.g. through access to finance and improving transparency of real energy performance in the local non-domestic building sector	**GMCA**, BBP?	I	FI	Med by 2020 High post 2020	**ERDF** Not secured	Encourage
• 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** UKGBC?	I, B1	SA	Medium by 2020 High post 2020	Not secured	Encourage
Reduce emissions from new developments: • Develop Greater Manchester-wide guidance on reducing emissions from new developments • Develop an evidence base and toolkit to assist planning officers in identifying policy requirements for mitigating the impact of emissions in new development and enabling occupants to adopt low carbon lifestyles	**GMCA**/ TfGM	I, B2	FI FI	Medium by 2020 Low-Medium by 2020	Not secured Not secured	Influence Influence

6.2 IMPLEMENTATION: ENERGY

Greater Manchester's success in delivering a low carbon economy and its ability to meet its social and economic needs is dependent on a fundamental transformation of its energy system, across generation, distribution, trading, management and use. The UK's system is changing at an unprecedented rate, and GM needs to be part of that change if it is to secure its share of the £200 billion national investment in a new energy system (Ofgem Discovery Strategy, 2009).

GM has established a strong collaborative platform across all sectors and the deployment of low carbon infrastructure is increasing. The links between the cost of energy and poverty, and the significant negative impact of energy prices, volatility and excess consumption on business productivity are proven. A radical and innovative local intervention is required in the way energy is sold, traded and purchased in order to strengthen the link between local spend and local investment, decrease the amount of infrastructure needed to meet demand and address inequalities, productivity, affordability and security.

Key achievements

- 72MW of renewable electricity generation capacity, producing around 70GWh electricity per year, saving around 30,000 tonnes of CO2
  - Direct deployment and `rent a roof' Photovoltaic cells
  - GMWDA anaerobic digestion and `energy from waste' plants
  - Hydro-generation in Stockport, Rochdale and Oldham
- Heat generation schemes include:
  - High rise biomass in Stockport
  - Air source heat pump deployment in Bury, Manchester and Wigan
- £270m has been invested in transforming the distribution system in 2013 and GM is undertaking nationally pioneering work on the transformation of domestic heat, system balancing of energy at local grid scale, energy storage and capacity trading. Plus £52m on energy innovation projects in 2013.
- A minimum of £110m in energy research in 2013 income has been secured across GM's academic institutions
- Tariff trials and switching campaigns reached 57000 residents, with 12-15% residents actively taking up the local offer.

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 CO_2. The council has recently applied for planning permission to build a 5MW solar farm in Heywood.

FUTURE PRIORITIES

2020 Vision: To establish the necessary capacity and policy framework, and start to implement major energy generation, distribution, 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.

Carbon Reduction Pipeline Delivery - By 2020, Greater Manchester will have established an investment pipeline of approximately £300-500m low carbon energy generation projects. This will include some 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, smart heat, energy from waste. We envision that some of the current Local Authority lead wind feasibility work will come to investment. There are significant opportunities for more activity with the potential to generate long term income streams.

Enabling Actions - Smart systems will enable energy consumers to understand their usage and to actively minimise their bills via demand shift. Network capacity and demand will be actively forecast and managed to optimise current infrastructure, and enable new demand and generation to be connected without significant new infrastructure being required. Smart systems and technologies will also release significant capacity from existing infrastructure.

Encourage wider private, community and public sector projects - Learning from the experience of delivering local authority projects can be readily transferred to the wider GM public and private sector. Partners will contribute to this target via delivery of their own low carbon infrastructure schemes, including domestic energy generation (PV) and community lead generation schemes (e.g. Hydro) which will require further investigation.

GM will achieve this by delivering the following actions:

Commitment	Lead and partners	Impacts	Action Type	Carbon Savings	Funding Potential	Local Action
Carbon reduction pipeline delivery: • Deliver existing PV projects and establish a pipeline of local authority-lead photovoltaic installations	**Local Authorities** and LCPDU	R, £1	CA	Medium By 2020 High post 2020	Capital secured Revenue unsecured	Delivery
• Complete Local Authority lead onshore wind assessments and deliver a programme of onshore wind investments	**Local Authorities**, GMENDG	R, £1	CA	Medium by 2020	Local Capital and revenue unsecured	Delivery
• Deliver a programme of identified local heat networks and plan for their longer term integration	**LCPDU**,Local Authorities, Private sector partners	R, £1	CA	Low by 2020 Medium post 2020	Revenue secured Capital part secured	Delivery
• Review existing research and assess the potential for geothermal energy across GM. If viable, develop appropriate schemes	**GMCA**	I, £1	FI	Medium post 2020	Revenue unsecured	Encourage & possibly Delivery
• Replace Greater Manchester's street lighting with smart controlled LED systems	**LCPDU,** Local Authorities, Private sector partners	R, £2	CA	Medium by 2020 high post 2020	Local Capital and revenue secured	Delivery
Enabling Actions: • Undertake detailed masterplanning and design a long term energy infrastructure plan and map for Greater Manchester through the ETIs Smart Systems and Heat Programme.	GMCA, ETI (SSH), ENW, GM P&H team	£1	CA	NA	Local and National revenue secured	Influence
• Build a business case for and, if viable, develop and operate a municipal energy company and supplier licence for Greater Manchester to strengthen the link between local spend and local investment	**LCPDU**	I, £1	FI	NA	Local revenue secured for feasibility but not development	Influence
Encourage Non LA Lead Projects: • Support accelerated delivery of the National Grid Innovation fund in Greater Manchester	ENW	I, £1	CA	High post 2020	Local capital and revenue secured	Encourage
• Encourage the wider uptake of renewables in the domestic, private and wider public sector through power purchase agreements, finance and connection innovation.	**GMCA**, Local Authorities	R, £1	SA	Low by 2020 high post 2020	Local revenue secured	Influence and encourage
• Encourage the development of commercial and community-lead wind, heat, biomass, PV, hydro-energy and other renewable and low carbon projects through supportive planning policies and facilitated access to funding and advice.	**Local Authorities**, GMCA, Community Groups, Private sector, DECC	R, £1	SA	Low by 2020 high post 2020	Local revenue secured **ERDF unsecured**	Influence and encourage

6.3 IMPLEMENTATION: NATURAL CAPITAL (GREEN SPACES AND WATERWAYS)

GM's natural capital includes its wildlife, lakes, rivers and man-made waterways, urban green space, open countryside, gardens, street trees, forests and farmed land. Together this creates a high quality natural environment and public realm. This benefits the quality of life of residents and businesses within GM as well as directly sustaining 15,000 jobs and generating £470m of GVA. All too often this is taken for granted and undervalued.

The National Ecosystem Assessment shows that, nationwide, over 30% of the services provided by our natural environment are in decline. The 2010 Lawton Report, *Making Space for Nature*, found that nature in England is highly fragmented and unable to respond effectively to new pressures such as climate, economic and demographic change. The review fed in to the Government White Paper on the natural environment. This recommended a new landscape scale approach to the natural environment and call for new strategic 'local nature partnerships' to champion this new approach. Ensuring our Natural Environment delivers this value and other critical services is a pre-requisite for GM as a city region competing at a global level for inward investment and tourism. It was for these reasons that the 'Greater Manchester Natural Capital Group' was set up, and why the range of 'Natural Capital' activity in the original GM Climate Change Implementation Plan 2012-2015 was identified.

Key achievements

With its vision to promote the natural environment and develop understanding of key ecosystem services, particularly those helping GM to become more climate resilient, much has been achieved by the Greater Manchester Natural Capital Group (NCG) and its partners since 2012. We have improved our understanding of GM's natural assets and how they are managed. Activity is being increasingly coordinated across green infrastructure, waterways and biodiversity issues. We are also further developing our understanding of the role our natural environment and the key ecosystem services it provides play in improving heath and well being and helping GM become more climate resilient.

As a result, we are being increasingly successful in influencing others and securing resources to protect and improve GM's natural capital, including:

- Designating the 'Great Manchester Wetlands' as GM's first 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
- Piloting the Environment Agency's River Stewardship 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 deculverting 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, the Atlantic Gateway Parkland's initiative and, at national level, dialogue with DEFRA about the future role of LNPs.

FACT Carbon Sequestration: GM's natural assets store and sequester approximately 21 million tonnes of carbon a year, reduce flood risk and also aid cooling – GI Framework (2010)

FUTURE PRIORITIES

2020 Vision: Our natural environment, and the ecosystem services it provides, still need to be both protected and enhanced in light of increasing pressures from people, the economy and a changing climate. Our natural capital must also contribute to the sustainable economic growth investments we plan to make, 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, through NCG and its partners active coordination, leadership and influence, have seen:

- No net loss in habitat quality or extent as measured by LCH operational performance measures from a 2014 Baseline.
- A year on year increase in the external funding secured for delivery of physical natural environment enhancement projects
- Wide recognition as being ambassador and champion of the natural environment, playing an increasingly active role within GM in support of the development and delivery of its plans and strategies.

GM will achieve this by delivering the following actions:

Commitment	Lead and partners	Impacts	Action Type	Carbon Savings	Funding Potential	Local Action
• Develop GM's natural environment evidence base and local priorities and consider as part of the production of GM Spatial Framework	NCG, GMCA, Universities	N1	CA	NA	Local revenue secured	Influence
• Secure funding for direct natural environment enhancement projects such as: ○ Identification of funding to support Natural Deal skills development. ○ A full beneficiary in a successful Water Framework Directive focused LIFE Integrated Project. ○ Natural health outcomes embedded in GM Public health activity and wider commissioning and provisioning activity	NCG, GM LEP, Environment Agency, LWT/ Groundwork, GMPH	N3	CA	NA	Local revenue unsecured Local, national and international **LIFE** Capital and revenue unsecured	Deliver and influence
• Improve the management of our key natural features targeting activity on our key habitats – such as lowland and upland peat bogs (which will also sequester carbon).	NCG, LWT, GWork, RFF/Forests Trust/PEF	N2	FO	Low	Local and national revenue and capital part secured	Influence and encourage
• Plant 3m trees across Greater Manchester by 2020 as part of the Manchester City of Trees initiative, to create shade and sequester carbon.	RRF	I	CA	Low	Local revenue and capital part secured	Deliver and encourage

6.4 IMPLEMENTATION: TRANSPORT

In Greater Manchester road transport contributes 75% of emissions of nitrogen oxides and 81% of particulates. It also accounts for 32% of carbon dioxide emissions. On both motorways and major roads, large goods vehicles contribute the greatest proportion of the NOx emissions, followed by cars. For carbon and particulates, cars are the main source of emissions.

Given the contribution of transport to emissions, it is not surprising that the GM Air Quality Management Area reflects the location of the motorways, major roads and urban areas. In terms of the effect on people and health, this is greatest where high density residential areas coincide with major highways.

Future growth predictions suggest that, if no action is taken to change the way we travel, the current 4.24m tonnes of CO_2 in transport emissions - 26% of GM's total direct emissions (in 2012) is set to increase. The introduction of the EURO VI engine will lead to reductions in NOx and PM emissions, however, this will not be sufficient to meet the required levels by 2020. These pollutants also pose significant public health risks which can impact greatly on society.

Greater Manchester's objective, in order to reduce emissions and help improve air quality, is to encourage a significant reduction in the number of journeys taken by road by promoting travel by alternative modes, alongside external transport industry processes that are improving engine technology to reduce CO_2, nitrogen oxides and particulate emissions.

Changing travel behaviour will require a number of related actions to encourage residents, visitors, businesses and commuters to make more sustainable choices.

Key achievements

- 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.
- 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 full-electric buses operating as part of the Metroshuttle service in Regional Centre.
- Introduction of electric bikes to enable travel choices and business engagement to a wider potential audience.
- Rail electrification work and the development of the Northern Hub

Case study

In summer 2014, the first fully-electric buses in Manchester went live as part of the city-centre Metro-shuttle service, a free service around the city centre. A charging point has been installed just outside Piccadilly Rail Station, alongside a key interchange of the Metro-shuttle routes. Each electric Metro-shuttle vehicle travels 200 miles per week. By using a pure electric vehicle, as opposed to a diesel hybrid vehicle, 80 litres of fuel is saved, and drive-train emissions are reduced by 17 tonnes of CO_2 to 0 tailpipe tonnes of CO2. The introduction of these vehicles has consequently removed over 50 tonnes of CO_2 that is no longer emitted in the City Centre.

FUTURE PRIORITIES

2020 Vision: To 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 and encourage behavioural change.

There are a range of transport options which could be considered. Over 95% of Greater Manchester's transport emissions come from road vehicles and, at present, private car users generate 60% of carbon, 66% of PM_{10} and 37% of NO_x road transport emissions. Continued encouragement in the uptake of smarter travel choices and the introduction of ULEVs will help to reduce impacts on both short and long journeys in GM. HGV's and buses make up a relatively small amount of road transport but contribute significant amounts to emissions. Public transport accounts for 15% of GM transport usage which means that there is significant but limited scope when it comes to reducing emissions through public transport. The key priorities therefore include:

- Implement Planned Infrastructure improvements
- Change Travel behaviour
- Reduce emissions from Heavy Good Vehicles
- Stimulate the Uptake of Ultra Low Emission Vehicles (ULEV)
- Reduce emissions from buses on key local corridors

GM will achieve this by delivering the following actions:

Commitment	Lead and partners	Impacts	Action Type	Carbon Savings	Funding Potential	Local Action
Implement planned infrastructure improvements: • Cross City Bus • Leigh Salford Manchester Busway • Rail Electrification • Cycling Infrastructure expansion	TfGM / Highways / Network Rail/ Highways / Bus Ops	R, T1, T2, T3, B2	CA	H	Secured	Deliver
Changing Travel Behaviour • Introduce the get me there smartcard system across tram, bus and train • Introduce an integrated fares system across all modes in Greater Manchester • Continue to offer an extensive Travel Choices programme, to encourage people to switch more of their journeys to sustainable transport and to better manage deliveries • Encourage home working through improved broadband use	TfGM	I, T2, B2, C4	CA	L-H	Secured	Influence
Reducing emissions from heavy good vehicles: • Develop the freight and logistics strategy to align the GM approach	TfGM	I	CA	L-H	Secured	Influence
• Support new rail or canal-served distribution centres subject to planning conditions		I	FI	M	Unsecured	Encourage
• Develop a pilot Urban Consolidation Centre on the Oxford Road Corridor in Manchester and assess the feasibility of at least two further UCCs within the City Centre.		R	SA	L-M	Currently in bidding process for European funding	Deliver
• Work with the industry and customers to raise awareness and actively promote sustainable distribution.		I	FO	L-H	Small amount secured	Encourage
• Work closely with other agencies such as the DVSA, Interreg, Universities and the Police to develop interventions which encourage safe and sustainable distribution.		I	CA	L-H	Unsecured	Encourage
• Implement mechanisms on the Key Route Network to reduce congestion and improve journey time reliability		R	CA	L-H	Some secured; more required	Deliver
Stimulate the uptake of ULEVs • Make the case for funding to stimulate deployment of electric vehicles	TfGM	R, B2	CA	H	Unsecured	Influence
• Demonstrate potential for alternative fuels (incl hydrogen) in transport infrastructure	MMU	T4, E1	FI	H	Unsecured	Influence
• Work with local authorities to set stricter emission standards for taxis and consider low emissions zones	TfGM	I, B2	SA	M	Unsecured	Influence
• Investigate the potential to introduce joint procurement for low emission vehicles in the public sector	TfGM	I	SA	L	Unsecured	Influence
Reducing Emissions from Buses on Key Urban Corridors • Set minimum standards for bus vehicles using the Cross-city Bus Infrastructure and future bus priority schemes	TfGM	R, B2	SA	M	Mechanism being developed	Deliver
• Establish consistent standards across Greater Manchester through bus franchises	TfGM	I ,T1,T3	SA	M	Secured	Influence
• Identify cost-effective ways of accelerating the replacement of pre Euro IV buses	TfGM	I, B2	FI	M	Unsecured	Influence

6.5 IMPLEMENTATION: SUSTAINABLE CONSUMPTION AND PRODUCTION

Within the GM Climate Change Strategy, Sustainable Consumption and Production (SCP) relates to the efficient use of energy and resources to produce goods and services (excluding those elements covered elsewhere e.g. building fabric) and minimising the amount of products and services that we consume and dispose of. SCP will therefore increase GM's productivity, save carbon and create jobs. It will also reduce the economy's exposure to a number of growing risks including material and energy scarcity, price volatility and risks from carbon sensitive supply chains. Through the creation of local demand and direct support to companies operating in the sector, GM will bring new more environmentally beneficial products and services into the market. At the most fundamental level, a low carbon future must be a resource efficient one.

When considering consumption based emissions, an understanding of resource flows are critical to strategies for reduction. Making GM more resilient to future resource scarcities and global shortages (whether physical or geopolitical) in supply needs to be based on an understanding of global trends and local needs.

A combination of both strategic and practical actions will achieve a more productive, resource efficient, low carbon city region by 2020 through continuous economic and social progress that makes best use of resources to meet the needs and aspirations of Greater Manchester's economy.

Key achievements

- Municipal recycling rates and level of waste diverted from Landfill are increasing
- Establishment of Resource Efficiency business support service as part of the GMC Green Growth service in 2013 which has delivered:
  - 400 businesses assisted
  - £1m of new sales won and £7.5m safeguarded
  - £9.7m in cost savings identified and £1.1m realised
  - 90 Kt of annual CO_{2e} savings identified an 1 ktCO2e realised and accruing year on year
- Research on understanding low carbon behaviours and carbon footprinting of GM food chain
- A new, GM-wide, online business pledge has been launched to help companies understand the range of improvements they could make and to help them communicate their commitments to staff and customers.
- Cooler have engaged 6 local authorities and 20 Registered Social Landlords in Carbon Literacy programmes as well as businesses locally and nationally.
- Development of a GMCA wide Social Value Procurement Policy

Case Study: Resource Rescue – GM Fire
Fire services don't pay for water to extinguish fires, so it's no surprise that fire services don't accurately measure the amount of water it takes. Recognising that this resource 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.

FUTURE PRIORITIES

2020 Vision: By 2020 the qualitative and quantitative contribution sustainable production makes towards GM's low carbon ambitions will be clearly understood, 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 as a driver for change. Public sector resource efficiency (excluding building fabric) requires further investigation with local authorities. Low carbon practices need to be embedded within procurement and other services through increased knowledge and training. Our aspirations for commercial resource efficiency include both publically funded business support activity (equivalent to doubling of the current target in the ERDF programme) and private sector lead.

Priorities for future action include:

- Increase the sustainability of our waste collection and disposal systems
- Supporting businesses, organisations and people to be more aware and resource efficient
- Increase the efficiency of resource use within Local Authorities and wider public sector

GM will achieve this by delivering the following actions:

Commitment	Lead and partners	Impacts	Action Type	Carbon Savings	Funding Potential	Local Action
Increase the sustainability of our waste collection and disposal system: • Reduce Void capacity within the Municipal Waste Collection System	**GMWDA** / LAs	I,C1	CA	59 ktCo2e	Secured	Deliver
• Increase the value of recyclates / energy removed from the waste stream	**GMWDA** /LAs	I, C1	CA		Secured	Influence
• Increase kerbside collection recycling rates by communication, reducing residual waste capacity/void space and proportionate enforcement to contribute to an overall Greater Manchester recycling rate of 50%.	LAs	I, C1	CA		Secured	Deliver
• Develop the services at Household Waste Recycling Centres to increase recycling, composting and Diversion from Landfill.	**GMWDA**	I, C1	CA		Secured	Deliver
• Increase Landfill Diversion to 81.3% in 2015/16, 82% in 2016/17 and 85% in 2017/18.	**GMWDA**	I, C1	CA		Secured	Deliver
• Undertake targeted campaigns to around 10% of GM households in 2015/16.	**GMWDA**/ LAs	I, C1	CA		Secured	Encourage
Support businesses, organisations and people to be more resource efficient: • Double the impact of MGC resource efficiency support to SMEs, and develop complimentary services within the existing offer	**Business Growth Hub**, GMCA LAs ERDF	R, C1 C3	CA FO	High by 2020	Future Local and EU/**ERDF and Interreg** funds unsecured	Deliver
• Encourage all businesses to take action on emissions reduction, climate resilience and accessing the low carbon economy	**BGH,** GMCA, Carbon literacy programme etc.	I, C2, C3	CA FO	NA	Future Local or national revenue unsecured	Encourage
• Engage people and organisations in carbon literacy/ behavioural change programmes for energy efficiency, emissions reduction and resilience e.g. practical suggestions for individuals and organisations to take action on consumption can be found in the Manchester A Certain Future Annual Report http://macf.ontheplatform.org.uk/content/macf-annual-report-2015	**Cooler CiC** Business LAs RSL	I, S3	CA	NA	Local revenue unsecured	Encourage
• 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**	I,	SA	Medium	tbc	Encourage
Increase the efficiency of resource use within Local Authorities and wider GM public sector: • Ensure that Social Value clauses are included in Public Contract's, that they are monitored and enforced	LA's; Public Sector Bodies	R, C2	CA	Low by 2020 high post 2020	Local revenue secured	Influence
• Identify and share existing best practices within Local authorities	**LA's,** GMCA	I, £2	FI	NK	Local revenue secured	Encourage
• Investigate and if practical support the development of a sustainable food board for Greater Manchester	**Voluntary Public & private Sector**	R, I, C4	CA	Low	Local revenue part secured	Encourage

6.6 IMPLEMENTATION: DEVELOPING A LOW CARBON SECTOR

Delivering emissions reduction and adapting to a changing climate will create employment and boost productivity and innovation in Greater Manchester. The UK and global market for products, technologies and services to achieve this is rapidly growing e.g. China will need to invest $6.6tn by 2025 to meet its GDP/tonne target (Business Insider, 2015).

Currently there are 2000 businesses employing 38,000 people supplying low carbon goods and services in GM. Improving resource efficiency is key to addressing business productivity. Supporting these businesses and others that want to diversify will help deliver the transition to a low carbon economy in GM.

The low carbon and environmental goods and services markets are still experiencing growth rates of over 4% despite the recession and offer a real opportunity for growth. However, opportunities to maximise the benefit for Greater Manchester may be missed if the opportunities for businesses based in GM aren't optimised.

Actions to reduce CO_2 emissions and develop a more sustainable Greater Manchester will generate demand for low carbon and environmental goods and services. It is important to ensure that T opportunities are identified and that maximum added value for the economy and residents of GM is realised from the plan.

The establishment of the Greater Manchester Growth Company has provided a key opportunity to integrate the low carbon opportunity across inward investment, business support, skills and marketing activities. The current MGC Green Growth service has engaged with over 750 SMEs and provided support to help them boost productivity and increase profitability by improving resource efficiency and reducing exposure to environmental risk or diversify into the Low Carbon and Environmental Goods and Services (LCEGS) sector.

Key achievements

- Launched and delivered a low carbon and environment sector development business support programme in 2013 and part of the GMC Green Growth service, which has delivered:
  - 142 SMES receiving light touch support and 56 SMEs receiving 1-1 support;
  - 19 jobs created;
  - over £1.3m of new sales increased
  - 600 companies receive
- Developed and published a suite of low carbon `propositions' 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. These were aimed at increasing 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

Case Study: Building a future of sustainable engineers

Opened in September 2014, the Greater Manchester University Technical College (The GM) is shaping our future workforce and leaders of tomorrow by preparing them for the world of work and developing the experience and skills needed to start a career in sustainable engineering.150 new students each year will have the chance to 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. Learning about this technology is just one of the many ways in which 'real' engineering is integrated into the curriculum.

FUTURE PRIORITIES

2020 Vision: Make a rapid transition to a low carbon economy by enabling businesses to optimise their potential, raising the profile of the sector, increasing understanding of the economic contribution of the sector and co-ordinating support in GM to 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 businesses, residents and the public sector to improve their resource efficiency (see SCP)
- 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

GM will achieve this by delivering the following actions:

Commitment	Lead and partners	Impacts	Action Type	Carbon Savings	Funding Potential	Local Action
Support businesses to diversify into low carbon sector: • 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.	**MGC** / BGH	S1	CA FO	NA	Local and int'national **ERDF** revenue unsecured	Deliver
• Monitor the impact of the Social Value Procurement Evaluation Framework - as adopted by AGMA - connecting local LCEGS suppliers to opportunities being created in GM by the public sector.	**GM Procure Hub**, LAs, BGH	I, S1	CA	NA	Local revenue unsecured	Influence
Attract high value low carbon businesses to GM: • Attract inward investment from UK and overseas LCEGS companies to GM	**MIDAS**	S1	CA	NA	Local revenue part secured	Deliver
Promote and exploit the existing low carbon sector: • Monitor and measure the overall growth of the sector in terms of jobs, sales and companies	**New Economy**	S1	CA	NA	Local revenue unsecured	Influence
• Raise the profile of the LCEGS sector in GM – e.g. via case studies, impact reports, GIS maps, research reports, virtual network	**MGC** / BGH & LCH	I, S1	CA	NA	Local revenue unsecured	Influence
• Exploit and promote the cutting edge research developed by our universities and harness the innovations that arise from it.	**Universities**	S1	CA	NA	National / EU **Horizon 2020** funding part secured	Encourage
Develop and integrate the skills required: • Ensure apprenticeship and training targets are met by the procured GM delivery partners.	**Skills and Employ't Partnership**, Local Authorities	S2	FO	NA	Local revenue secured	Influence
• Identify the skills demands that will be required to deliver the low carbon and transitional investments planned for GM.	**Skills and Employ't Partnership**, GM Chamber	S2	FI	NA	Local revenue unsecured	Influence
• Work with colleges, universities and training providers to articulate needs for skills development in the GM low carbon economy	**Skills and Employ't Partnership**, GM Chamber	S2	CA	NA	**ESF**?	Encourage
• Bidding for funding to deliver affordable training on low carbon building design specifically for the SME design / build sector, driven by local policies on low carbon requirements in new build	**Skills and Employ't partnership, Local Authorities**	S2	SA	I	**ESF?**	Encourage

6.7 IMPLEMENTATION: CLIMATE RESILIENCE

We are facing a projected increase in average global temperature of at least 2 degrees by 2060 (possibly 4 degrees) causing significant social, environmental and economic impacts to GM, its people and its economy. Both the GM Strategy: Stronger Together and the GM Climate Change Strategy recognise the pressing need to prepare and plan for this rapidly changing climate and manage the impact that the expected extreme weather will have on the city region.

Driven by the development of evidence and advice from within our expert academic and other institutions, GM is already demonstrating considerable leadership and progress on this agenda. We have made good progress both locally, as a City Region and as a voice nationally in our understanding of and planning for climate change. However, many businesses, particularly SME's, are still not taking action and where we are increasing the physical resilience of our places and buildings, this still tends to focus on addressing flood risk impacts only. A wider consideration of the full range of GM's climate risks and how these increase over time does not often occur.

GM's future climate risks conspire with other economic, health and social factors to affect some of our most vulnerable individuals and communities. These individuals and communities may be least able to prepare and recover from climate impacts and therefore will be most impacted by GM's changing climate.

Key achievements:

We now better understand and have begun to plan for the impacts of climate change on our businesses, places and people. As a result we have:

- A thorough academic understanding of GM's key Climate Change (CC) risks and their spatial impacts. We are also starting to identify our most at risk and vulnerable communities.
- A well respected and effective business (particularly SME) support offer which already signposts businesses towards climate change risk issues and tools for addressing these impacts.
- considered climate impacts, particularly flood risk, through our spatial planning and utilities and infrastructure investment processes.
- Begun to explore how we might embed resilience in our low carbon buildings programmes, particularly domestic retrofit.
- 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
- become a full partner in the H2020 Climate Resilient Cities and Infrastructures project, securing E1m for AGMA and University of Manchester to support planners and decision makers in GM over the next 3 years in increase our climate resilience.

CASE STUDY: **GM Fire and Rescue Service (GMFRS) Sustainability Strategy**

GMFRS doesn't just put out fires, but also deal directly with the results of a more volatile climate: flooding, wildfires, more frequent and severe storms and heat waves. Greater Manchester's rescue experts are responding to a rapidly increasing number of extreme weather disasters at home and overseas. In February 2014, 90mph winds blew down trees and shattered windows. There were more 999 calls than on bonfire night and we know that if we don't curb climate change, this will happen more often. This has driven GMFRS to set an ambitious new strategic direction, committing to become an organisation with a net positive environmental impact by 2050. In the words of the Chairman of our Fire Authority: *"We've made a great start, but in the future we don't just want to be an organisation that reduces its impact on the environment, we want to leave it in better shape than if we did not exist."* – Cllr David Acton

FUTURE PRIORITIES

2020 Vision: We already have a good understanding of our climate risks and how to plan and respond to the extreme events associated with them. We now need to ensure we deliver a resilient and 'well adapting' GM by rapidly moving from understanding and planning to taking direct action to reduce and manage these risks by increasing 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
- Consider the wider impacts of climate change on our building stock
- Embed actions for increased resilience into our plans and strategies

GM will achieve this by delivering the following actions:

Commitment	Lead and partners	Impacts	Action Type	Carbon Savings	Funding Potential	Local Action
Use our increased understanding of climate change impacts: • Assess how it will impact our most vulnerable communities and support these in directly increasing their preparedness and resilience.	**GMLRF** Universities	Rs	SA	NA	Local revenue Unsecured	Influence
Increase further the resilience of our businesses: • Explore opportunities to develop and deliver more targeted Climate Change (CC) resilience awareness raising and behaviour change schemes to GM's SME's through GM's direct business support offer and carbon literacy programmes • Encourage businesses to understand, plan and manage their climate risks via our public sector procurement practices.	**Business Growth Hub** **Cooler CiC**	Rs	FO SA	NA	Local revenue Unsecured **Horizon 2020 secured**	Encourage
Consider the wider impacts on our building stock: • Expand the consideration of climate impacts within our low carbon building retrofit activity from flood risk to other climate impacts. • Embed understanding and action within wider built environment interests such as RSLs and into non-domestic activity	**GMCA** Horizon 2020	Rs	FO	NA	Local/EU **Horizon 2020** Revenue secured	Influence
	GMCA	Rs	FO	NA	Local/EU **Horizon 2020** Revenue secured	Influence
Embed resilience into our plans and strategies: • Ensure our plans and strategies, particularly the GM Spatial framework, fully considers the implications of climate change on growth levels and locations both now and over the likely lifetime of the developments.	**GMCA** P&H Horizon 2020	Rs	SA	NA	Local/EU Revenue secured	Influence

7.0 MONITORING PROGRESS: TARGETS AND KEY PRIORITY INDICATORS (KPIS)

Key Priority Indicators

The following KPIS characterise Greater Manchester's Climate Change context

KPI description	Available data	2020 Target
CO_2 emissions (mt CO_2e)	15.325 (2013) updated from 16.145 (2012)	11 mtCO_2e
Tonnes CO_2/£m GVA	272	na
GM Renewable Energy Generation	0.54TWh/year electricity. Heat unknown (2013)	4TWh heat and electricity
Peak Demand	Accounting system being developed	
Energy Consumption	2012: 53.125TWh	
Percentage of people travelling other than by car	2012: 25%	35% (2018)
Properties in flood warning areas:	2012: 30,000	
LCEGS Sector*:		
Number of companies	2013 = 2000	
Number of employees	2013 = 38000	
Value of sales	2013 = £5bn	
Annual growth rate	2013 = 4.9%	
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)

*the Government's definition of the Low Carbon Sector (LCEGS) has changed in 2014

Operational Performance Measures

To ensure we're on the right track, we'll monitor progress against:

OPM description	Available data	Baseline (2013)	2020 target
CO_2 reduced by GM project pipeline			2.24 mtCO2e
Total installed Microgeneration 2010-15 (number) (2015)	22544		tbc
Total installed Microgeneration 2010-15 (capacity, MW) (2015)	72.023		tbc
In time, GM tariff uptake	0 (8,000 switchers)	0	25,000
Build and open Velocity 2025 cycle routes?	0 open	0	All open
Annual Carbon Savings achieved in companies assisted my MGC			58,000
Domestic waste materials recycled (% of total)	(40.85%)	40.85%	48% (2018)
Local Spend from public contracts	Indicator in place Aug 15	tbc	tbc
Research and innovation income at key GM institutions	£110m (2013)		£150m per annum
Car Journeys in GM (A&B Roads)	85.7%	tbc	tbc
Hybrid Deisal Electric Bus fleet make-up (GM)	21.70%	tbc	Tbc

Transparent Reporting: Greater Manchester will publish its key performance information and KPIs in an Annual Report in September of each year, and also on the Carbon Disclosure Project website in April of each year.

7.1 LOCAL AUTHORITY LEVEL DATA

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) (2015)	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

There are significant differences in the challenges facing Greater Manchester Districts and in their performance for tackling them. One of the key opportunities for Greater Manchester is the ability to share learning across the GM districts and raise the performance of all authorities to that of the best performer. An example of this opportunity is provided in Fig. 7 below.

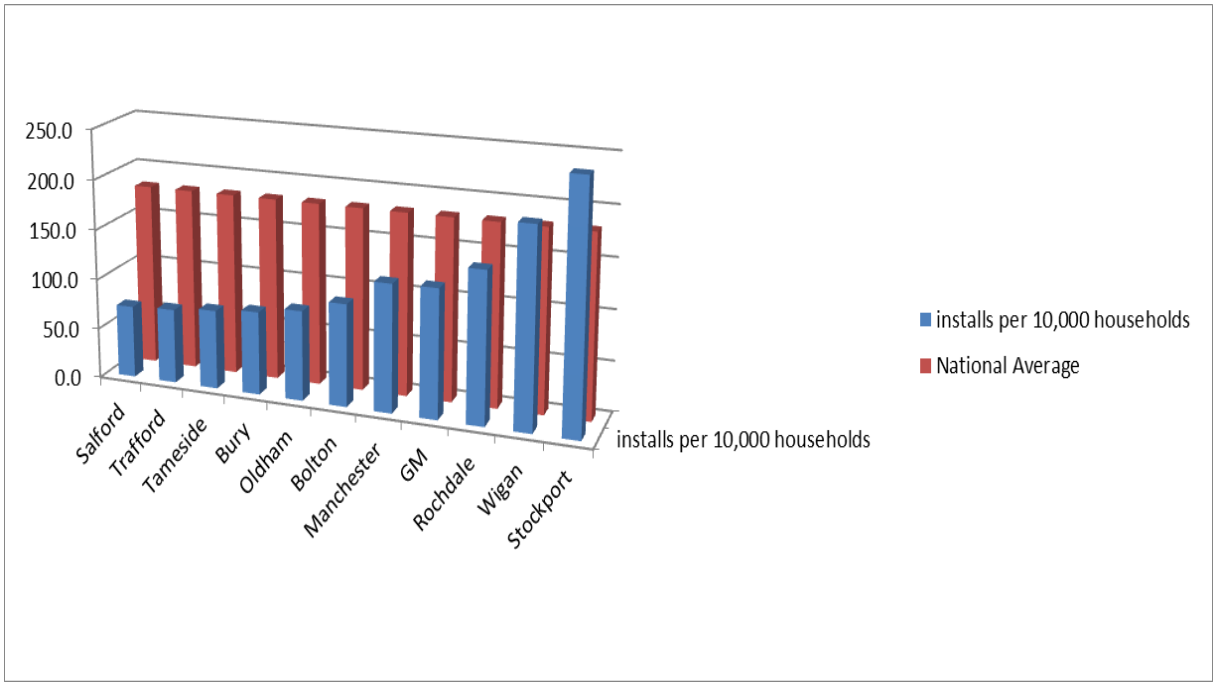


Fig. 7 - Installed photovoltaic capacity per GM District

8.0 LOOKING FORWARD: 2035 OBJECTIVES AND TARGETS

Greater Manchester is developing a future vision based on accelerated economic growth and increased population forecasts to 2035. Without a low carbon transition, separating economic growth from its environmental impacts, both of these contexts may act to drive up carbon emissions. Such a transition, if implemented successfully, could also have significant economic benefits through low carbon sector growth and reduced energy and resource costs.

In the 19th and 20th centuries, Greater Manchester shaped the Industrial revolution and funded the establishment of the original city infrastructure by establishing the UK's first municipal energy networks. In the 21st century, the opportunity and the means are available for Greater Manchester to demonstrate to the world how a locally determined infrastructure can support a city that enables low emission, healthy, affordable lifestyles and a thriving economy. This cannot be achieved solely by niche low carbon projects and programmes. A shift to mainstream delivery of a 2035+ low carbon vision will be necessary based upon:

- An active commitment and timetable to reduce and eventually eradicate fossil fuels wherever an alternative exists, and to be at the forefront of developing and commercialising viable alternatives, including fuelling infrastructure;
- To screen all investments and assets to divest of fossil fuel dependency for income or activity, and ensure that they are fit for purpose in a changed, more volatile climate;
- To implement a major shift towards electrification, decentralisation and smart energy systems in a socially just way which enables local spend on energy to be used to improve energy efficiency and affordability and deliver quality local low carbon infrastructure and jobs;
- To shift our response from cure to prevention in strategic health expenditure, taking account of the significant interrelationship between reduced emissions, air quality, green space, sustainable food, active lifestyles and fuel poverty in achieving positive health outcomes at home, while travelling and in the workplace.
- Recognising that air travel builds global perspective and is a major contributor to creating inclusive, aware and developed societies, significant steps to develop and deploy low carbon aviation infrastructure and fuels are needed to ensure that it is fit for purpose.

8.1 FUTURE TARGETS

A key aspect of this consultation is to consider what Greater Manchester's targets should be for 2035. Without longer term targets, we are in danger of setting our sights only on the near term and not identifying the more sustainable, longer term solutions.

The UK Climate Change Act established a target for the UK to reduce its emissions by at least 80% from 1990 levels by 2050. This target represents an appropriate UK contribution to global emission reductions consistent with limiting global temperature rise to as little as possible above 2°C. To ensure that regular progress is made towards this long-term target, the Act also established a system of five-yearly carbon budgets, to serve as stepping stones on the way (see Annex 1). The first four carbon budgets, leading to 2027, have been set in law. The UK is currently in the second carbon budget period (2013-17). Meeting the fourth carbon budget (2023-27) will require that emissions be reduced by 50% on 1990 levels in 2025. Government is likely to announce the UK's fifth carbon budget (2028-2032) in 2016, following the conclusion of negotiations on an international UN carbon agreement in Paris (COP 21) in November 2015.

In preparation for COP 21 a number of other sub-national states are calling for a sub-national approach to climate change and greater access to climate financing. 20 sub-national governments (representing 220m people) have put forward ambitious climate change targets for COP 21 discussions, including some who have already committed to a 90% reduction target by 2050.

One of the key questions for the consultation will be "on what basis should GM set its 2035 carbon reduction targets"?

9.0 ABBREVIATIONS & GLOSSARY OF TERMS

Potential Impacts of the Implemented Actions

R= Direct Carbon reduction – a clear carbon reduction which can be quantified or modelled
I = Indirect Carbon reduction or enabler (without which reduction cannot occur)
£ = economic growth potential
£1 = Economic growth, improved productivity, less poverty, reduced winter deaths.
£2 = Increased productivity, reduced public expenditure, improved road safety and public realm security
B1 = Higher building standards, lower energy bills, higher productivity.
B2 = Improved air quality
B3 = Reduced energy bills, reduced fuel poverty, local economic benefits
E1 = Support partners in developing and trialling future energy solutions, including delivering Hydrogen Partnership projects
N1 = A more robust, deliverable and sound GMSF with environmental capacity issues addressed within process
N2 = Potential Skills/employment benefits, local community environment capital/environment improvement
N3 = Skills/employment outcomes, wider health and wellbeing outcomes, supporting economic growth for any action delivering flood risk management via natural environment project
T1 = More bus/rail reliability, more bus journeys, less congestion, increased rail journey speed
T2 = More cycling, less congestion
T3 = Better passenger confidence / safety
T4 = Stimulate the development of an alternative fuel economy
C1 = Increased quantity and or quality Material Recovery
C2 = Increase Jobs, GVA,
C3 = reduce environmental risks
C4 = Improved health, social inclusion, biodiversity, adaptation
S1 = Jobs created & safeguarded and Sales won & retained (in LCEGS companies)
S2 = Skills levels of existing workforce increased.
S3 = Increase knowledge in Social Landlord staff and help reduce energy usage.
Rs = More resilient investment in economic growth, potential competitive advantage over areas / sectors of economy which are less resilient.

General

AGMA – Association of Greater Manchester Authorities BBP – Better Buildings Partnership BGH – Business Growth Hub DCLG – Department of Communities and Local Government DECC – Department of Energy and Climate Change ECO – Energy Company Obligation ENW- Electricity Northwest ERDF – European Regional Development Funds ETI – Energy Technology Institute FIT – Feed in Tariff GM – Greater Manchester GMENDG – Greater Manchester Energy Network Development Group GMLRF – Greater Manchester Local Resilience Forum GMPH – Greater Manchester Public Health GMWDA – Greater Manchester Waste Disposal Authority Gwork – Groundwork H2020 – Horizon 2020 EU funding programme LA – Local Authority LCH – Low Carbon Hub LCPDU – Low Carbon Project Development Unit LED – Light Emitting Diode	LEP – Local Enterprise Partnership MGC – Manchester Growth Company NEDO – New Energy Development Organisation (Japan) RRF – Red Rose Forest RSL – Registered Social Landlord Salix – Government backed 0% finance for low carbon projects SMBC – Stockport Metropolitan Borough Council tCO2e – tonnes Carbon Dioxide equivalents TfGM – Transport for Greater Manchester PV – Photovoltaic (cells) UKGBC – UK Green Building Council

ANNEX 1 – Existing UK Targets

Air Quality Targets

The European Ambient Air Quality Directive 2008 (2008/50/EC) sets legally binding limits for key pollutants in the air we breathe outdoors:

Pollutant	***Concentration***	***Averaging period***	***Permitted exceedences each year***
Fine particles (PM2.5)	25 µg/m3	1 year	n/a
PM10	50 µg/m3	24 hours	35
	40 µg/m3	1 year	n/a
Nitrogen dioxide (NO2)	200 µg/m3	1 hour	18
	40 µg/m3	1 year	n/a
Sulphur dioxide (SO2)	350 µg/m3	1 hour	24
	125 µg/m3	24 hours	3
	266 µg/m3	15 minute mean	35
Lead (Pb)	0.5 µg/m3	1 year	n/a
Carbon monoxide (CO)	10 mg/m3	Maximum daily 8 hour mean	n/a

UK Carbon Budgets

Budget	**Carbon Budget Level**	**% Reduction below base year**
1st Carbon budget (2008-12)	3,018 MtCO2e	23%
2nd Carbon budget (2013-17)	2,782 MtCO2e	29%
3rd Carbon budget (2018-22)	2,544 MtCO2e	35% by 2020
4th Carbon budget (2023-27)	1,950 MtCO2e	50% by 2025

ANNEX 2 – Greater Manchester Low Carbon Wedges Analysis

THEME	Asset Class	Best estimates in ktCO2e *							
		Technically Feasible Savings No Timescale	Potential local savings by 2020		Known Current GM Public Pipeline	Delivery Through		Level of Policy Influence Needed	Level of Encouragement Needed For Wider Activity
			GM Public	Private		Existing Public Pipeline	Extended Public Pipeline		
ENERGY	Commercial Generation								
	Wind	1402	40	133	0	Low	CA	Medium	Medium
	PV	378	CBE	CBE	2	Low	FO	High	Medium
	Energy from Waste	CBE	53	NA	10	CBE	FI	Medium	High
	Heat Networks	162			62	High	CA	High	High
	Hydro	35	NA	1	0	Low	SA	Medium	Medium
	Micro generation								
	Wind	Included in Commercial					FI	Medium	High
	PV						FI	High	High
BUILDINGS	Domestic EE								
	Retrofit	1160	15	NA	40	Low	FO	High	Medium
	Heat Pump		0	NA	1	Low	FI	High	High
	Boiler	National Building Regs							
	Non Domestic EE (Heat)	95							
	Public	95	53	0	13	Medium	CA	Medium	
	Commercial	CBE	0	NA	0	CBE	FI	Medium	Medium
SCP	Resource Efficiency								
	Domestic	NA	NA	NA	NA	NA	FI	Medium	Medium
	Public	107	NA			Low	FI	Medium	
	Commercial	932	108	125	10	Low	FO	High	Medium
TRANSPORT	Transport								
	Public	NA			12	NA	FI	Medium	Medium
	EV	1621	NA	NA		Low	FO	High	High
	Choices	127			102	High	CA	Medium	Medium
	Price signal	200				Low	FI	High	Medium
	Cycle infrastructure	135			27	Medium	CA	High	Medium
	Home working	NA	NA	27		NA	FO	Low	Medium
	Driver training	NA	NA	27		NA	FO	Low	Medium
NCG	Carbon Sequestration	NA	NA	NA	NA				
	Total	**5,194**	**269**	**313**	**279**				

NA - not available **CBE - can be estimated** **Minimum value**

NATIONAL POLICY			
	Building Regulations	NA	258
	UK Heat Strategy	NA	29
	Zero Carbon Homes	NA	89
	Electricity System Reform	NA	2,240
	Low carbon vehicles / biofuels	NA	293

Parameters	Ranking	Level of Policy Influence Needed	Level of Encouragement Needed For Wider Activity	
				Start Action (SA)
	Low	Projects likely to go ahead at the required scale	Projects likely to go ahead at the required scale	**Continue Action (CA)**
	Medium	Projects likely to go ahead but not at the required scale without Policy Intervention	Projects likely to go ahead but not at the required scale	**Further Opportunity (FO)**
	High	Projects unlikely to go ahead without Policy Intervention	Projects unlikely to go ahead	**Further Investigation (FI)**

Links for further Information

AGMA	http://www.agma.gov.uk/
Greater Manchester Low Carbon Hub	http://www.agma.gov.uk/low_carbon_hub/index.html
Transport for Greater Manchester	http://www.tfgm.com
Greater Manchester Waste Disposal	http://www.gmwda.gov.uk/
GM Business Growth Hub	http://www.businessgrowthhub.com/
On the Platform (Hub Comms Site)	http://gmlch.ontheplatform.org.uk/
Manchester A Certain Future	http://macf.ontheplatform.org.uk/

Supported by the GM Low Carbon Hub Board:

Cllr Sue Derbyshire, Chair of GM Low Carbon Hub Board
Steve Rumbelow, Lead Chief Executive Officer, Rochdale Council

Anne Selby, Chief Executive Officer, Wildlife Trust for Lancashire, Greater Manchester & North Merseyside
Councillor Elaine Sherrington, Bolton Council
Councillor Eunice Smethurst, Wigan Council
Ian McAulay, Executive Director, Pennon Group plc & Chief Executive Officer, Viridor.
John Thompson, Strategic Planning Manager, Environment Agency North West
Louise Blyth, Executive Producer, BBC Academy
Nigel Mellors, Pro-Vice-Chancellor for Research & Enterprise, University of Salford
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