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AGMA
ASSOCIATION OF GREATER MANCHESTER AUTHORITIES

Sustainable Energy Action Plan

A report to inform and help shape energy priorities in Greater Manchester

July 2010

Northwest
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Manchester: Knowledge Capital will be publishing a Technical Appendix in September 2010, to accompany this report, on www.manchesterismyplanet.com

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Section 1
Introduction

1.1
What is the Sustainable Energy Action Plan?

This Sustainable Energy Action Plan (SEAP) report has been developed to provide evidence to inform and help shape energy priorities in Greater Manchester (GM). The report has been developed by Manchester: Knowledge Capital (M:KC) with support from Arup. Funding was provided by the European Commission's Intelligent Energy in Europe 'Partnership Energy Planning as a tool for realising European Sustainable Energy Communities' (PEPESEC) programme to pilot the sustainable energy action planning process in GM. The PEPESEC programme and sustainable energy action planning methodology has informed, enabled and supported the development of this report.

The report aims to provide city leaders and managers with a coherent, evidence-based and prioritised action plan to shape a sustainable energy system. This SEAP report is not intended to be a 'plan' that will then be implemented and followed, but forms the first step in an iterative process of shaping, testing, implementing and evaluating actions to shape GM's energy systems. The process aims to build the partnerships necessary to deliver change, and achieve political buy-in to both the sustainable energy action planning process and the this SEAP report.

The SEAP report aims to contribute towards shaping energy priorities by:

- Developing an understanding of GM's current energy use and carbon dioxide (CO_2) emissions (Section 2);
- Supporting the delivery of the national, sub-regional and local CO_2 reduction targets. This includes the GM Strategy target to reduce CO_2 emissions by 30% to 40% by 2020 and understanding how they relate to national and individual local authority (LA) CO_2 targets (Section 3);
- Bringing together evidence of current and future actions that contribute towards CO_2 reduction targets (Sections 5-12);
- Understand changes and actions likely to occur outside GM's sphere of influence and how these may influence CO_2 emissions (Sections 5-12);
- Identify and prioritise further actions needed to support CO_2 reduction targets based on research, quantification of impacts and consultation. (Sections 5-12);
- Identify how actions could be implemented, with indications of actors and timescales (Section 5-12 and Appendix A); and
- Contributing to understanding of how potential actions may interplay with concerns about energy security and affordability in GM (Section 4).

The project has helped to identify GM's energy knowledge, capacity and business assets which can help to both deliver a secure, sustainable energy system and low carbon economic growth.

The suggested energy actions will have significant economic implications, both in terms of implementation costs and in the role actions will have in securing the onward viability of GM as a world class city region. Significant economic value will arise from the actions, and it will be important to ensure that this value is effectively harnessed within the GM economy as the actions are implemented.

This plan recognises the importance of securing low carbon economic growth, and identifies potential stimuli. However, its scope and focus is on the technical and practical steps needed within energy system to inform wider strategic development, rather than the economic development activities, which feature elsewhere in the GM Environment Commission's work programme.

1.2
Which Authorities Constitute GM?

GM covers ten Local Authorities (LAs), who also make up the Association of Greater Manchester Authorities (AGMA). GM is made up of the eight metropolitan boroughs of Bolton, Bury, Oldham, Rochdale, Stockport, Tameside, Trafford, Wigan, and the cities of Salford and Manchester.

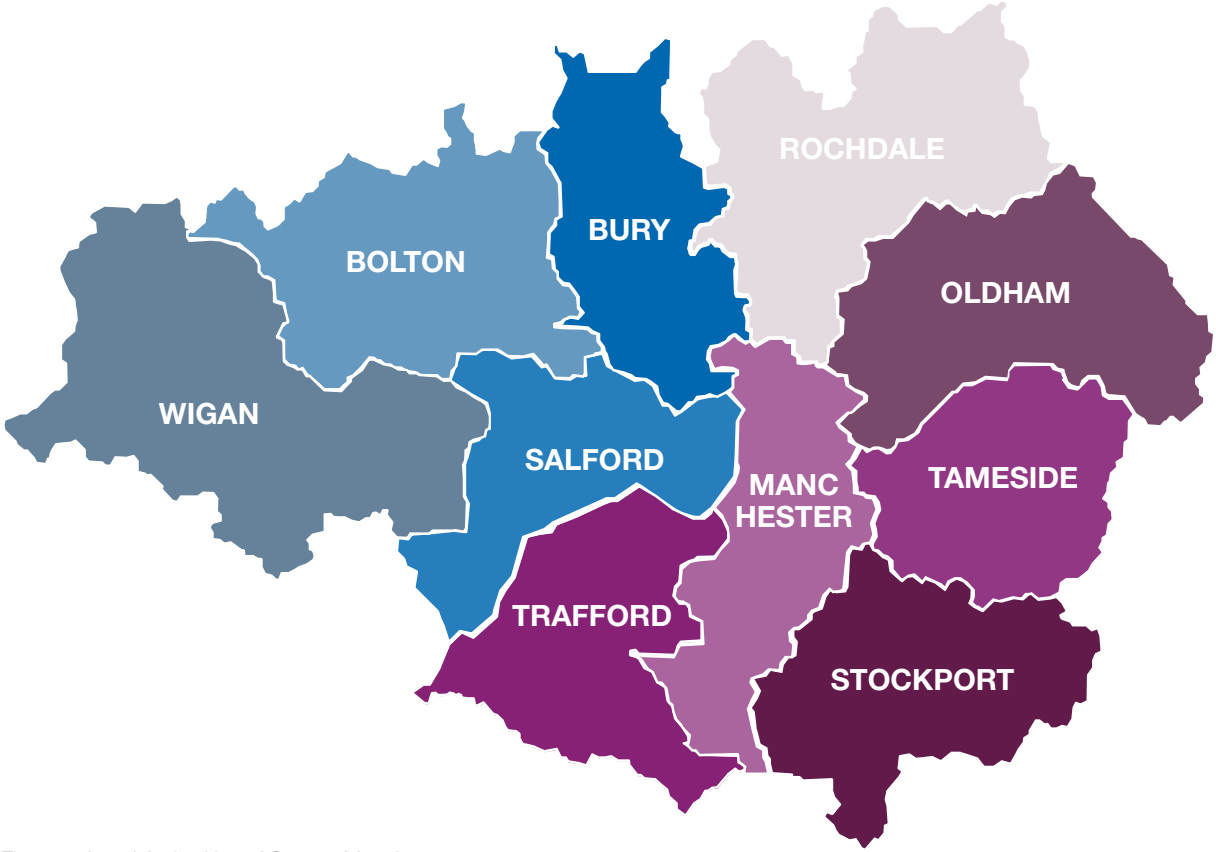


Figure 1: Local Authorities of Greater Manchester

1.3 Why Does Greater Manchester Need Action on Energy?

The Greater Manchester Strategy sets a vision for GM stating that:

'By 2020, the Manchester city region will have pioneered a new model for sustainable economic growth based around a more connected, talented and greener city region where the prosperity secured is enjoyed by the many and not the few.

Three elements of this vision aim for:

- Sustainable economic growth;
- A greener city region;
- Where prosperity is enjoyed by the many and not the few.

A sustainable energy system is essential to meeting these goals.

1.3.1 Energy and a Greener Greater Manchester

It is now universally accepted that warming of the climate system is already happening and that a significant part of this warming is associated with greenhouse gas emissions produced by human activities. It is widely accepted that we need to limit a rise in temperatures to 2°C to avoid 'dangerous climate change'[1]. Achieving CO_2 emission reductions to limit climate change to this level has formed the basis of targets set at the international and national level. CO_2 is the most significant of the greenhouse gases in the UK because CO_2 forms 85% of our greenhouse gas emissions and there is evidence to suggest that it will be easier to reduce these emissions than emissions from other gases (CCC, 2008).

To deliver a 'greener city region' and play its part in climate change mitigation, the GM Strategy aims to reduce CO_2 emissions by 30-40% by 2020 compared to 2005 levels. In the UK, 98% of our CO_2 emissions emanate from the burning of fossil fuels to meet our energy needs. Therefore, the challenge of climate change mitigation and delivering a 'greener city region' is essentially a challenge to deliver a sustainable energy system.

1.3.2 Energy and Sustainable Economic Growth

Energy is indirectly or directly linked to every business activity. The commercial sector requires energy to light and heat its buildings and power its computers. The industrial sector requires energy to manufacture products, bring raw materials to factories and take products to consumers. The transport sector requires energy to power its rail, road and air vehicles.

If businesses cannot obtain a secure[2], affordable supply of energy, it impacts on their ability to carry out its functions effectively and can mean that businesses will become less competitive on the global market. Conversely, businesses which can obtain reliable, cheaper sources of energy will have lower overheads and can become more competitive than businesses that have more expensive energy supplies.

The UK Industry Taskforce on Peak Oil and Energy Security concluded that:

'The era of cheap oil is behind us and we must plan for a world in which oil prices are likely to be both higher and more volatile'.

Therefore, to ensure GM businesses remain competitive and deliver sustainable economic growth, GM must deliver and maintain a sustainable energy system. This system must minimise energy use and increase low carbon and renewable energy generation, whilst ensuring the energy supply remains secure and affordable.

[1] *It should be noted, however, that there is uncertainty about the level of CO_2 reductions that will need to be made to achieve this reduction and that some groups argue that limiting increases in temperatures to 2°C does not go far enough.*

[2] *For the purpose of this report a secure supply of energy is defined as a supply that can be relied upon to meet the demand for energy when it is required, at a price that is not prohibitively volatile. A household is deemed to be in fuel poverty when householders spend more than 10% of its income on household fuel to meet a defined heating regime.*

1.3..3 Energy and Prosperity for the Many

Energy is a vital component of everyday life for GM residents. GM residents use energy to heat their homes, cook their food, power their televisions and travel to work, school, leisure and retail. Between January 2003 and September 2008 it is estimated that the average domestic dual fuel bills (gas and electricity) increased by 125%. This has left poorer residents experiencing fuel poverty[3], which often means residents find it difficult to afford energy to meet their basic needs for heating, lighting and cooking. It has been estimated that without interventions the energy price impact of measures to address the UK's carbon budgets[4] will put another 1.7 million UK households into fuel poverty by 2022 (Fuel Poverty Advisory Group, 2009). It is estimated that 4 million people were in fuel poverty in 2008, so this would mean an increase of over 40%.

To ensure prosperity for many, GM must take steps to minimise fuel poverty. A sustainable energy system can help minimise fuel poverty by increasing energy efficiency (e.g. introducing insulation and double glazing to homes) and thereby reducing the amount that a household spends on energy. As above, future rises in the price of fossil fuels associated with rising global demand, diminishing supplies and financial incentives for cleaner energy means that moves towards renewable and low carbon sources of energy can reduce future fuel poverty. Conversely, however, measures to reduce CO_2 emissions could mean rises in energy prices. As fossil fuel generation primarily relies on existing generation infrastructure, the initial capital costs of deploying low carbon energy infrastructure render their supply more expensive than fossil fuels in the short term. Therefore, GM will need to carefully target its measures to reduce deprivation, and may need to introduce mechanisms to protect deprived communities from fuel poverty.

To ensure prosperity for many, GM must harness the jobs and economic potential that can be delivered through a transition to a low carbon economy. Work undertaken by Innovas (2010) has identified the significant jobs growth and economic potential associated with the low carbon technologies and services sector in GM. Importantly, this sector provides a potential source of jobs for people of all skill levels and from many different professions. Manual work can be required in the delivery of retrofit and other physical infrastructure projects, providing a grounding that could lead to more technical, engineering or team leadership activities. New employment could also be provided for professionals with a wide range of research, financial and contractual, analysis, planning, project management, ICT, science, technical and engineering skill sets.

1.4 How will a Sustainable Energy Action Plan Help to Deliver a Sustainable Energy System?

This SEAP report aims to support the aims of the GM Strategy, whilst providing evidence to support local, sub-regional and national policies and actions. The SEAP report recognises and builds upon previous baseline research and studies; takes into account national, regional and local policies; and adds value through identifying those actions that can make a real difference to the delivery of a sustainable energy system. Two stakeholder workshops were held on 25th and 28th May 2010 to discuss targets and actions for the SEAP report. Stakeholders have also been engaged throughout the process through e-mail correspondence, face-to-face meetings and through the AGMA Energy Group. Further stakeholder engagement and partnership building will be essential for the delivery of actions.

[3] *A household is deemed to be in fuel poverty when householders spend more than 10% of its income on household fuel to meet a defined heating regime.*

[4] *A carbon budget is a cap on the total quantity of greenhouse gas emissions emitted in the UK over a specified period of time. In 2009 the UK set legally binding carbon budgets for 2008-2012, 2013-2017 and 2018-2022 that aim to reduce total greenhouse gas emissions in the UK. This estimate incorporates costs to deliver technologies such as nuclear power and carbon capture and storage.*

The diagram in Figure 2 illustrates the stages involved in developing this SEAP report and the iterative process following publication of this document. Amongst other sources, the process has been informed by best practice in Europe and the SEAP guidance (EU, 2010).

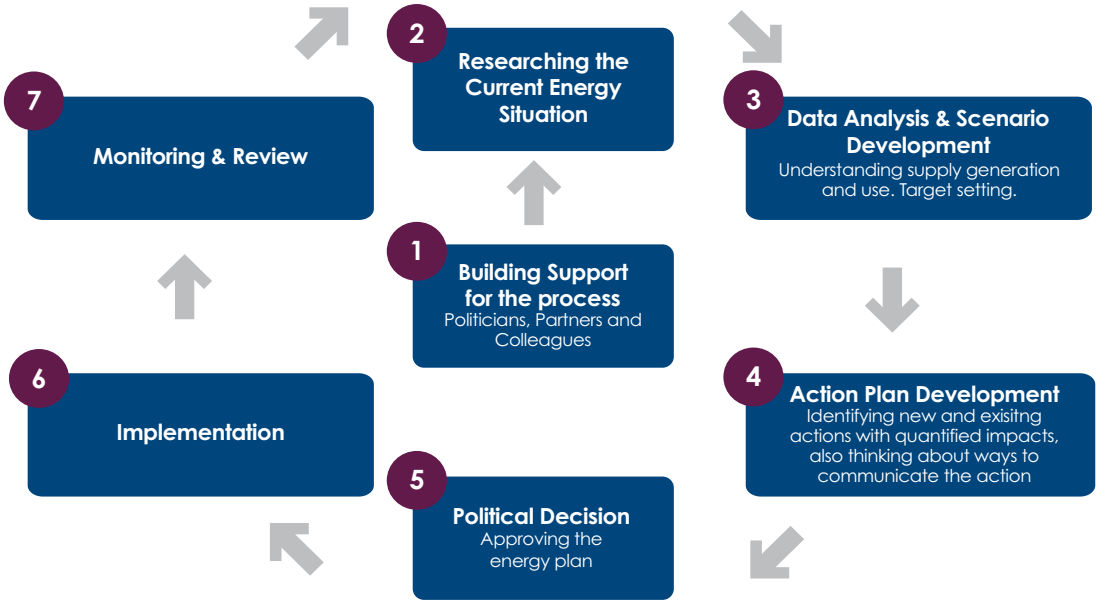


Figure 2: Sustainable Energy Action Planning Process

AGMA's actions have enabled M:KC with the support of Arup to complete stages 2-4, and produce the first SEAP report. Stages 5 and 6 will be taken forward by the body identified to co-ordinate the sustainable energy action planning process in the future.

1.5 Acknowledgements

This SEAP report has been developed with vital input; assistance and feedback from a large number of public and private sector stakeholders. We would like to acknowledge assistance particularly from the European Commission Intelligent Energy programme for Europe, the North West Development Agency and the following:

AGMA, (including the GM Energy Group, its Environment, New Economy, Planning and Housing, and Transport Commissions and all the individual authorities), Bruntwood, Carbon Trust, Carlton Power, Centre for Construction Innovation, Department of Energy & Climate Change, Department for Environment, Food & Rural Affairs, Domestic Energy Alliance, Electricity North West, Energy Saving Trust, Envirolink Northwest, Enworks, Environment Agency, Friends of the Earth, Greater Manchester Chamber of Commerce, Greater Manchester Geological Unit, Greater Manchester Joint Transport Team, Greater Manchester Public Transport Executive, Greater Manchester Waste Disposal Authority, H2ope, Highways Agency, Joule Centre, Malmo Municipality, Manchester Digital Development Agency, Manchester Metropolitan University, National Energy Action, National Grid, Northern Rail, North West Regional Development Agency, Office of the Gas & Electricity Markets, Pannone, Peel Holdings, Salix Homes, Skäne Energy Agency, Sustrans, Stage Coach, Transport Watch, University of Manchester, University of Salford, UK Climate Impacts Programme, Urban Mines, Urbed, Urban Mines, Urban Vision, Warm Zones CIC, Waste Resources Action Plan.

This is not an exhaustive list of acknowledgements and we would like to thank all contributors. The views expressed in this document have been informed by all input, but are not necessarily the views of any one consultee.

Section 2
Greater Manchester's Existing Energy System

2.1 Introduction

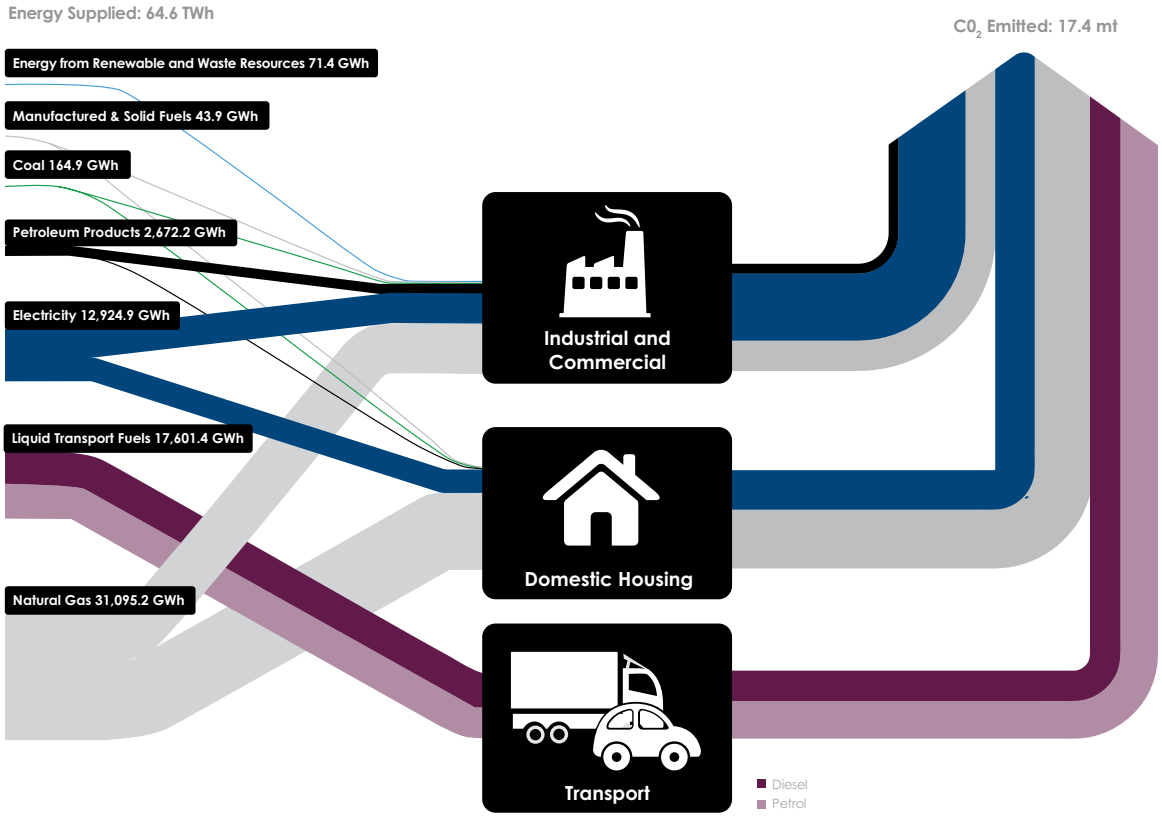
GM is home to 2.54 million people, inhabiting over 1.14 million homes, covering an area of 1,276 square kilometres. At the time of the last census GM was the second most densely populated area in the North West region behind Merseyside. This section aims to provide a brief introduction to UK energy supply systems and facilitate understanding of GM's energy systems, energy use and CO_2 emissions.

This section provides an overview of the energy use in 2005 as this is the 'baseline' year against which progress will be measured in this SEAP report. More detail on the targets and the baseline year is provided in Section 3.

2.2 Baseline: Introduction

To effectively manage the reduction of our CO_2 emissions it is important to understand how GM's energy use translates to CO_2 emissions. The Sankey diagram in Figure 3 shows where GM's energy came from in 2005, what sector energy was used in and the resultant CO_2 emissions.

It is estimated that in 2005 GM business and households collectively spent £2.2 Billion on gas and electricity and these costs are set to rise in the future



Source: DECC Total and Final Energy Consumption at Regional and Local Authority Level (2005)
DEFRA GHG Conversion Factor Guidelines for Company Reporting (2009)

Figure 3: GM's Energy Supply and CO_2 Emissions in 2005

2.3
Baseline: Energy Use by Fuel Type

The section below explores the main energy sources used in GM, and then examines in detail at renewable and low carbon energy generation in GM.

Figure 4 shows energy used by fuel type, and Figure 5 shows the resultant CO_2 emissions.

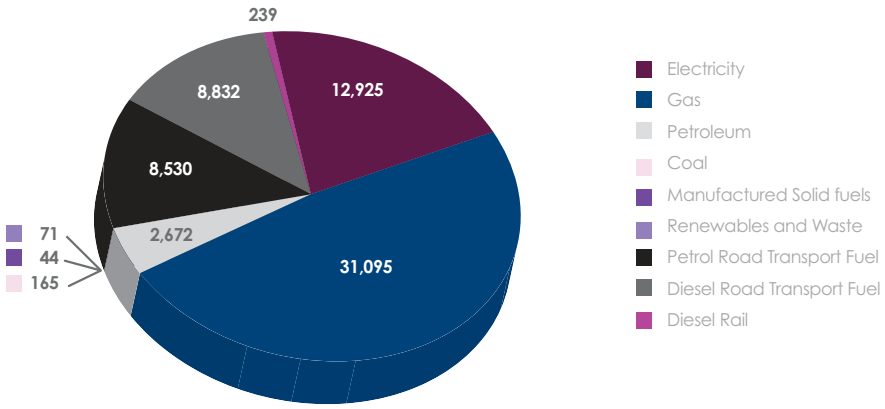


Figure 4: Energy consumption (GWh) by fuel source in GM for 2005

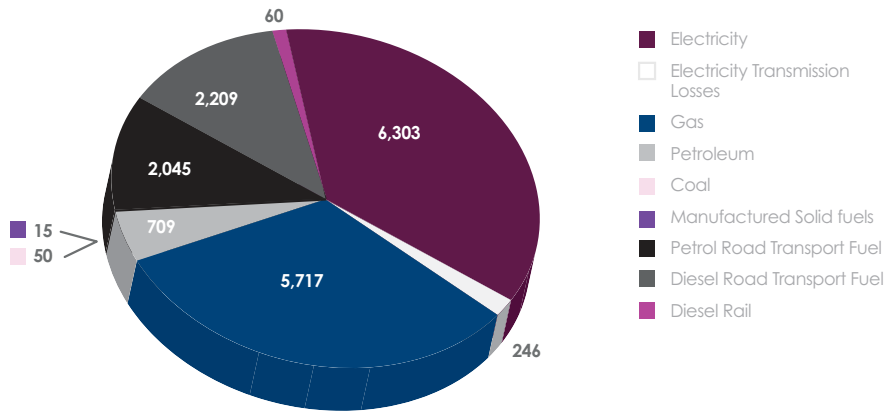


Figure 5:CO_2 emissions ($ktCO_2$) from energy consumption in GM in 2005 by energy source

2.3.1
Natural Gas

In 2005 natural gas accounted for 48% of GM's total energy consumption and 33% of GM's CO_2 emissions. Over 65% of the gas used was used for space heating and cooking in the residential sector. Manchester and Stockport are the only LAs that have large industrial and commercial/service sector gas users[5]. Gas is distributed in pressurised distribution systems. Some very large gas users receive gas from the high pressure distribution system, whilst most customers are supplied using the low pressure distribution system. The natural gas distribution system is more flexible than the electricity network because it is possible to store significant amounts of gas to cope with the demand peaks. Gas is also used to generate electricity, and this is explored in section 2.2.3.

Historically, the majority of the UK's gas needs have been met by gas supplies from the UK Continental Shelf (UKCS). However, these reserves are declining and the UK is becoming increasingly reliant on gas supplies from abroad.

This means that GM will not always be able to obtain a supply of gas that is as affordable and secure as it has been in the past. Figure 6 shows the past and future projections for UK gas. LNG stands for Liquefied Natural Gas, a gas that has been temporarily converted to liquid for ease of transport.

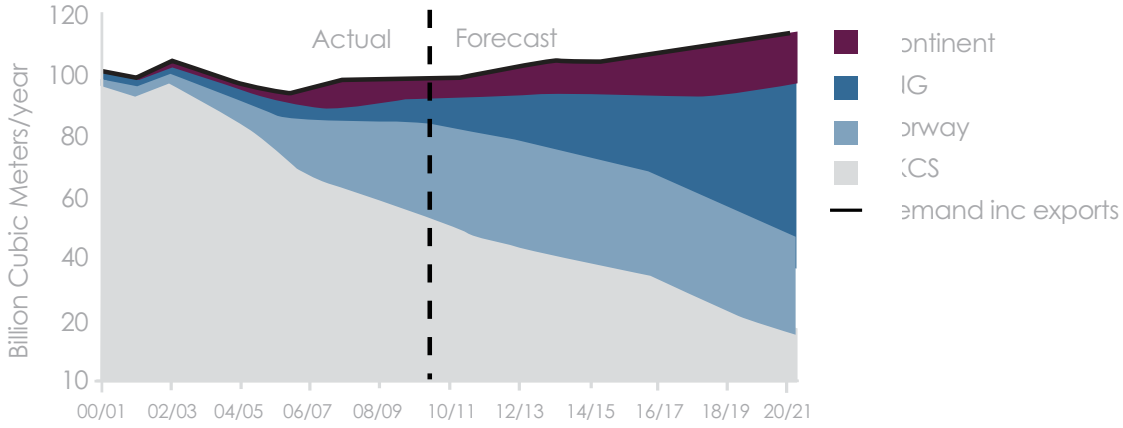


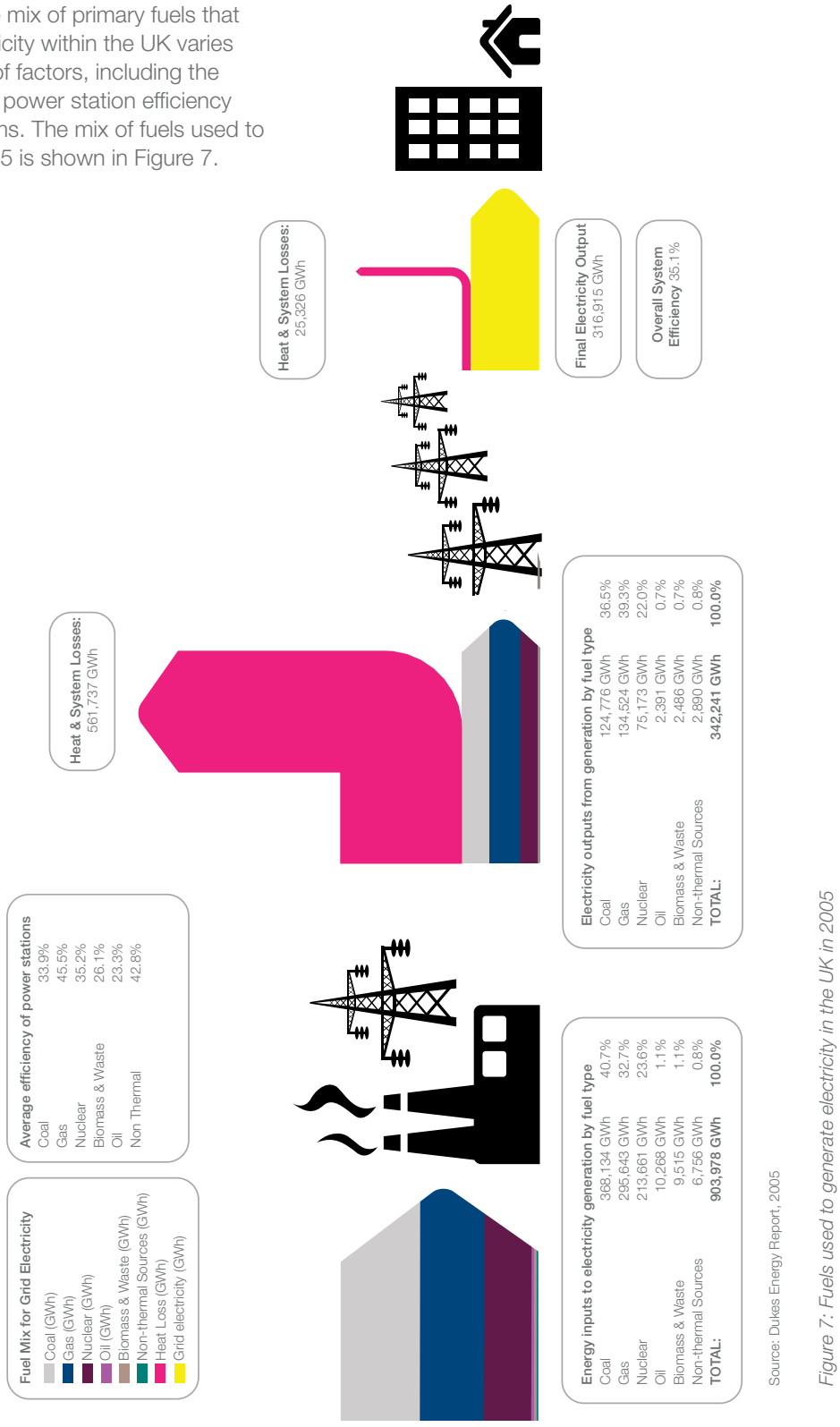
Figure 6: Sources of natural gas used in the UK

[5] *As defined by DEFRA carbon inventories.*

2.3.2 Electricity

Electricity in the UK

Electricity is often referred to as a secondary source of energy as it requires a primary source of energy to generate it. The mix of primary fuels that is used to generate electricity within the UK varies depending on a number of factors, including the price of the primary fuels, power station efficiency and maintenance programs. The mix of fuels used to generate electricity in 2005 is shown in Figure 7.



Source: Dukes Energy Report, 2005

Figure 7: Fuels used to generate electricity in the UK in 2005

Figure 7 shows that in 2005 the UK was heavily reliant on fossil fuels with gas generating 37.7% of electricity and coal 35.8%. The electricity fuel mix has changed marginally between 2005 and 2009, but could change dramatically by 2020.

Electricity is not easily stored so the National Grid must attempt to generate electricity to match demand. Demand for electricity varies significantly depending on a large number of factors, for example, energy uses varies by:

- Development type (e.g. offices generally require more energy during the day, whilst residential buildings require more energy in the early mornings and evenings);
- Time of year (e.g. more energy is required in winter than in summer[6]).
- Events (e.g. a TV 'pick-up'[7]).

During England's World Cup match against Paraguay in 2006 National Grid projected an increase in demand of 1,500MWh

The challenge for generators and distributors of electricity is to ensure that sufficient electricity is generated and distributed to meet peaks in demand. This is significant because not all electricity generation methods can be 'switched on' to meet a peak in demand. There are essentially three types of electricity generation:

- **Generators whose output depends on natural occurrences (e.g. wind turbines only generate electricity when the wind is blowing).** These methods can contribute towards a base load but there must be a diversified supply to avoid power outages during particular weather conditions.
- **Generators whose output is relatively constant (e.g. nuclear and coal power plants constantly produce electricity and so can contribute towards meeting the base load[8]).** As their output is relatively constant, it cannot be increased sufficiently to meet the peaks in demand or decreased when demand is low. Outputs can be constant because of technical or economic issues associated with the plant.
- **Electricity generators that are flexible and can be 'switched on' (e.g. gas fired power stations).** These generators can be used to meet peaks in demand or compensate for lower generation from generators that vary with factors such as wind speed. This category can also include technologies that can 'store' electricity and release it to meet peaks in demand (e.g. Dinorwig hydro-electric power plants).

The 1800MWe Dinorwig hydroelectric scheme, in Snowdonia in Wales, pumps water up to a high altitude during off-peak times, then discharges to generate energy during peaks.

The UK needs a diversified energy supply to meet the base demand whilst being able to generate additional electricity to meet peaks in demand. Additionally, looking for new ways to store electricity could help cope with a situation where electricity is not always generated when needed. These concepts are important when looking at options for decentralised and renewable energy generation in GM.

Electricity in GM

Electricity used in GM is predominantly supplied through the National Grid. National Grid electricity accounts for 20% of GM's energy consumption and 36% of GM's CO_2 emissions. Therefore, the nature of the National Grid, explored above, has a significant bearing on GM's CO_2 emissions. Electricity North West Limited (ENW) owns and operates the electricity distribution network in North West England, distributing electricity to customers on behalf of the electricity supply companies. In 2005, over half the electricity consumed in GM was consumed by the industrial and commercial/service sectors. The LA areas using the most electricity in 2005 were Manchester, Trafford and Stockport.

2.3.3 Transport Fuels

Transport fuels accounted for 27% of GM's total energy consumption in 2005 and 25% of GM's CO_2 emissions. Around half of the transport fuels were consumed in diesel road vehicles and the other half in petrol road vehicles[9]. The LA areas that consume the most transport fuels are Manchester, Salford and Wigan.

[6] *Although this could change as climate change decreases the need for winter heating and increases the need for mechanical ventilation in summer.*
[7] *A TV pick-up is when there is a peak in demand caused by a television programme finishing or pausing for a break.*
[8] *The base load is the amount of power required to meet minimum demands based on reasonable expectations of customer requirements.*
[9] *Additionally, 1% of the total transport fuel consumed was used to power diesel trains.*

2.3.4 Petroleum Products

Petroleum products accounted for 4% of GM's total energy consumption in 2005 and 4% of GM's CO_2 emissions. The majority of the petroleum was consumed in the commercial/ services and industrial sectors. It is estimated that approximately 56% of the total petroleum consumed in these sectors was used for off road vehicles, 42% of was used as fuel oil and 2% was used in the agricultural sector. The LA areas that use the most petroleum products are Bolton, Wigan and Manchester. A few major consumers have pipeline supplies of petroleum, for example Manchester Airport.

2.3.5 Other Fuels

Less than 1% of GM's energy consumption was met using other fuels, with these other fuels including:

- **Solid fuel:** This includes Manufactured Solid Fuel (MSF), coal and wood. However the drive for low carbon fuels has driven a growth in the use of biomass (solid fuel derived directed from plants) so this could increase in the future; and
- **Renewable and low carbon electricity:** This is explored further in Section 2.6.

This report was unable to source reliable data for the utilisation of renewable or low carbon heat in GM, therefore this is not included in the analysis above. However, existing heat suppliers and the potential for increasing levels of renewable and low carbon heat generation is explored further in Section 2.3 and Section 6.

2.4 Baseline: Energy Use and CO_2 Emissions by Sector

In 2005 the domestic sector in GM consumed the most energy equating to approximately 40% of the total energy consumed and emitting 36% of the CO_2. The Industrial and Commercial/Services Sectors consumed 33% of GM's energy and emitted 39% of the CO_2, (3% from Industry[10] and 36% from Commercial). The transport sector consumed 27% of the total energy consumed and emitted 25% of the CO_2. Figure 8 shows the CO_2 emissions by sector[11].

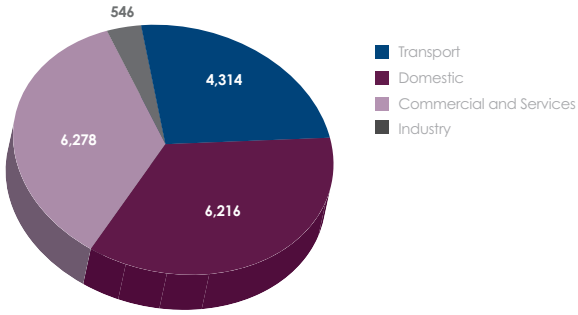


Figure 8: GM CO_2 Emissions by Sector in 2005

Data from 2005 shows that the domestic sector emits less CO_2 per unit of energy than the commercial/services, industrial or transport sectors. This is primarily because the domestic sector is heavily reliant on the use of gas for space heating, domestic hot water and cooking, which currently produces less CO_2 per unit of energy than electricity or transport fuels.

2.5 Baseline: Energy Use and CO_2 Emissions Per Capita

National Indicator 186 measures a reduction in total CO_2 emissions per capita so that measures of CO_2 also take account of population changes over time. This can be useful when considering changes in one area's emissions in the context of a changing population. However, a large number of factors can influence the relationship between population and CO_2 emissions, such as the nature of an area (urban versus rural) and the economic activities that take place within it (e.g. industrial area versus residential area). Therefore current thinking suggests that it is better to use residential CO_2 emissions per capita rather than total CO_2 emissions when comparing areas.

GM residents emitted 2.44 tonnes of CO_2 per capita from the residential sector. LA area emissions by sector are shown in Figure 9 against residential CO_2 emissions per capita.

[10] *3% CO_2 emissions figure has been taken from the "Developing Future Energy Scenarios for Greater Manchester" report, produced by University of Manchester & Carbon Captured - March 2010. The report is available to download from Manchester is My Planet website.*

[11] *The sectors are organised by consumer rather than producer. Therefore, emissions generated through the production of electricity used to boil a kettle would fall into the domestic sector rather than industrial and commercial.*

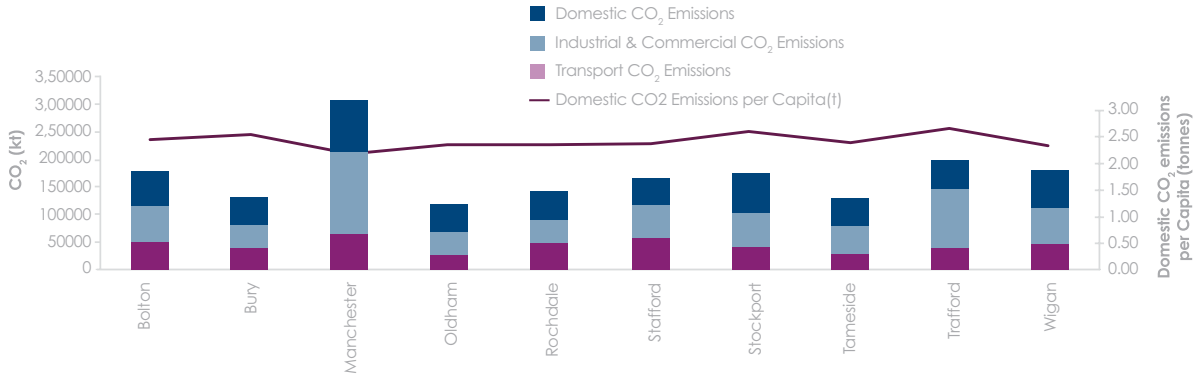


Figure 9: CO_2 Emissions by Local Authority and Domestic CO_2 emissions per capita

2.6 Baseline: Energy Generation and Heat Networks in GM

2.6.1 Decentralised Energy in GM

Decentralised energy currently meets a small proportion of GM's energy demand. Nationally derived decentralised energy statistics do not include all generation types and are modeled based on national assumptions. For greater clarity in GM, a separate methodology was developed for use in this report to understanding how much electricity generation comes from decentralised energy systems 200512.

Using this methodology it is identified that in 2005, GM had 162.9MWe of installed capacity. Out of the 162.9MWe, 8.81 MWe came from renewable energy technologies, and 31.46 MWe came from 'low carbon' sources (e.g. Energy from Waste), leaving the remaining 122.63 MWe fired from fossil fuel (see figure 10 – please note this does not include heat generated from CHP plants).

Many organisations have purchased 'green energy tariffs' as a means to reduce their CO_2 emissions. These tariffs comprise of a commitment from energy companies to match a proportion of energy consumption with renewable energy generation. This model has also been followed on a larger scale, with some organisations directly investing in large scale merchant renewable energy projects which are not located on their premises, as a means of 'offsetting' their emissions. Although such schemes have obvious merits, they do not directly impact on the role and function of GM's energy system unless such schemes are based within GM.

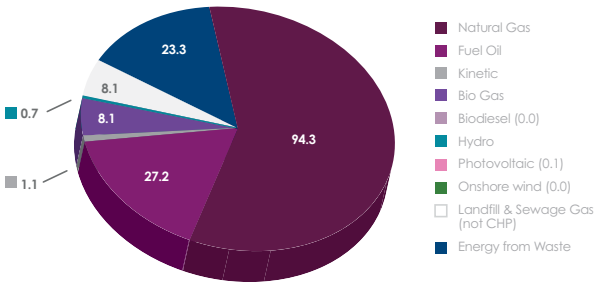


Figure 10: Decentralised Energy by Installed Capacity in GM in 2005 (MWe)

[12] *For further explanation of this methodology see the Technical Appendix published at www.manchesterismyplanet.com*

2.6.2 Heat Networks

Heat networks are the infrastructure that conveys heat from a point of production, to multiple consumers, be they homes or commercial premises. Heat that is transported to consumers via a network can either be produced by dedicated boilers or can use heat produced as a by-product of other processes (e.g. electricity generation). Actively planning to incorporate heat utilisation into industrial and energy production facilities can significantly improve the amount of energy generated for each unit of fuel and may be a cost effective way of meeting GM's CO_2 reduction targets.

Gas-fired electricity power stations are likely to be a feature of electricity production for many years to come, as a necessary part of the transition to lower carbon electricity. Therefore, measures to promote the development of Combined Heat and Power (CHP) facilities as part of gas-fired power stations will increase the efficiency of gas-fired generation plants and provide heat for local consumption.

Heat networks can, therefore, be one way to decrease CO_2 emissions from a fossil fuel source that is likely to remain part of our energy mix in the short to medium term.

Heat networks can distribute heat from a large number of different production facilities and utilise a range of fuel sources. For example, heat can be generated using gas, biomass, biogas, waste and as a by-product of industrial processes. Heat networks can use different fuel sources over time, taking advantage of the changing availability of fuels supplies. For example, in the short term, gas-fired CHP may be the fuel of choice for heat networks, but in the long-term this could be replaced by heat from energy from waste plants or biogas.

Over time, new sources of heat can be connected to an existing heat network. Heat networks could also be used in summer to provide a 'coolth' network if 'coolth' technologies such as ground/water source heat pumps or tri-generation technologies are connected to the network.

As with electricity, there are benefits and costs associated with using both dedicated boilers and heat as a by-product from other actions. Dedicated boilers may be able to generate heat more flexibly to meet demand, whereas heat generated as a by-product is likely to be generated depending on a third factor, such as when an industrial plant is producing a lot of goods.

In some parts of GM, particularly around the 1960's former social housing areas, there are existing heat networks. These operate with a central boiler generating steam or hot water which is then piped around the housing estate. Research has been conducted into the presence of existing heat networks in GM through the Decentralised and Zero Carbon Energy Planning study (DES) and subsequent LA studies (e.g. Manchester and Stockport). However, there is currently no known comprehensive database of existing GM heat networks or data on the extent to which existing heat networks are utilised. Given the potential for decreasing GM's CO_2 emissions using heat networks, and the potential cost-effectiveness of such interventions, a number of actions are suggested in this SEAP report to support heat networks in GM.

The Copenhagen district heating system is one of the world's largest, oldest and most successful, supplying 97% of the City with clean, reliable and affordable heating. The system cuts household bills by 1,400 EUR annually and is estimated to save 665,000 tons of CO_2 per year.

2.7
Energy and CO_2 Emissions Since 2005

2.7.1 Changes in Energy Use and CO_2 Emissions between 2005 and 2008

Initial trend data shows early signs of progress since the baseline year of 2005. GM reduced its energy consumption by 4.1% by 2007 whilst CO_2 emissions reduced by 3.6%. Energy consumption and CO_2 emissions decreased in both 2006 and 2007 (before the worst of the global economic crisis hit). Data for gas and electricity consumption in 2008 also shows a decrease across domestic, industrial and commercial and service sectors suggesting that this trend will continue. However, transport emissions remained constant between 2005 and 2007.

However, until GM has at least 5 years worth of energy and CO_2 statistics, caution should be taken in interpreting annual CO_2 statistics as reductions or additional emissions may reflect fluctuations in emissions rather than a trends. This is particularly the case in the last few years where changes could be a function of the economic downturn.

2.7.2 Change to Renewable and Low Carbon Energy Generation Since 2005

Numerous national, regional, sub-regional and local initiatives have begun to increase the installed generation capacity of renewable and low carbon technologies in GM since 2005. Figure 8 compares installed the installed capacity of schemes in 2005, with that in 2008 by technology. Generation using natural gas and fuel oil are also included.

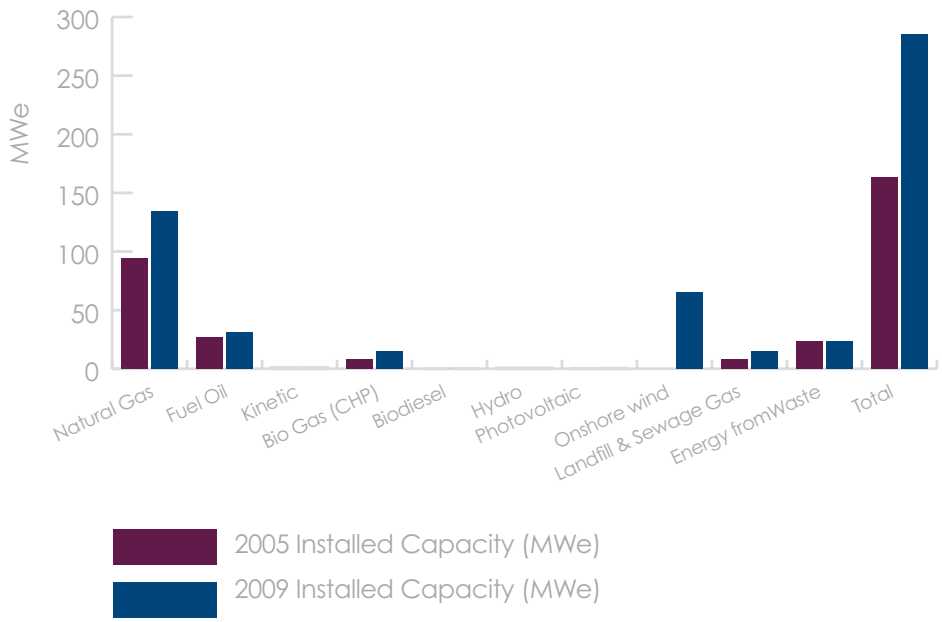
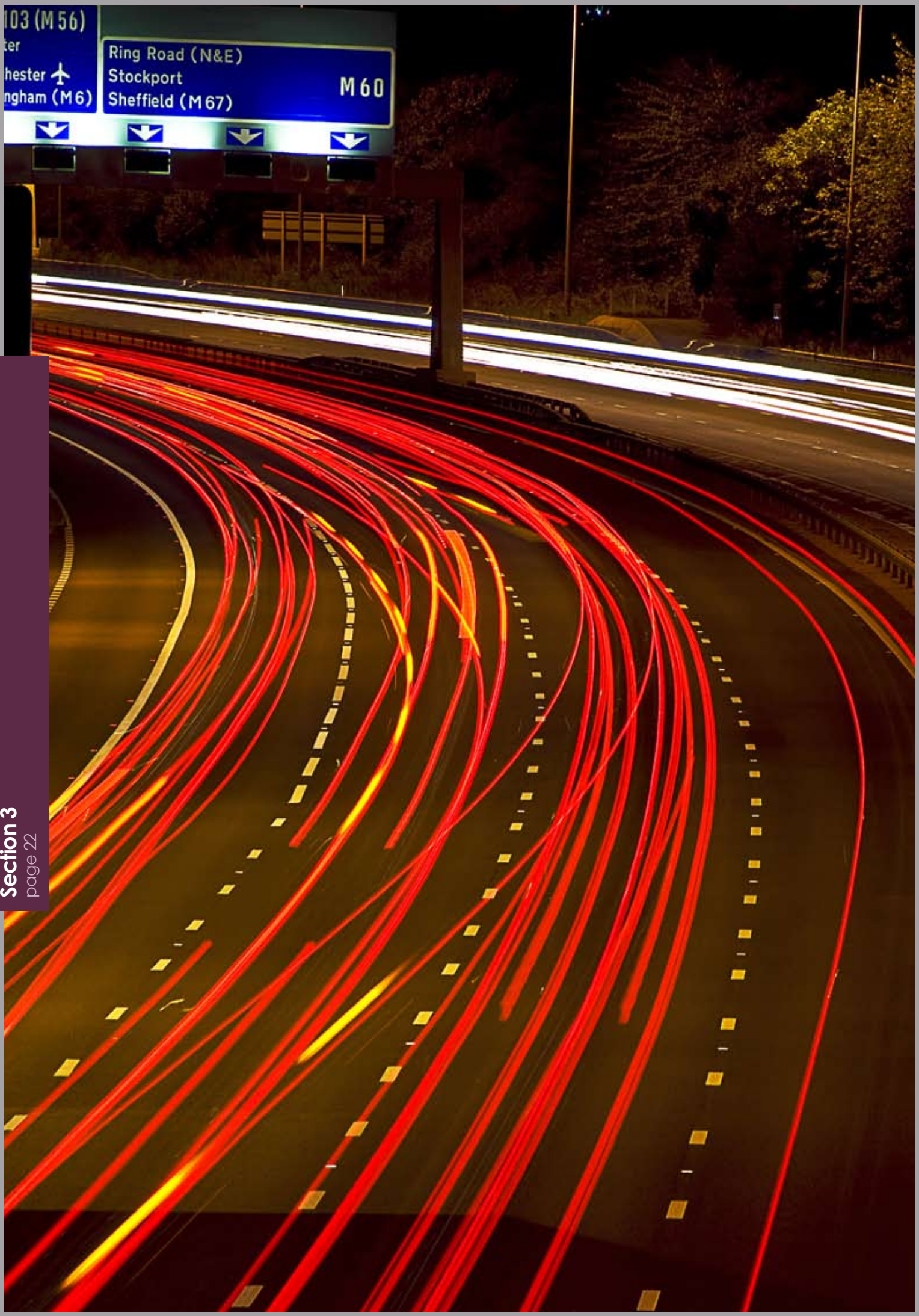


Figure 11: Installed Capacity of Renewable, Low Carbon and Fossil Fuel Generation in GM in 2005 and 2009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Section 3
Economic Growth and CO_2 Emissions

3.1 Introduction

The relationship between economic growth and CO_2 emissions is complex and this SEAP report does not attempt to begin to resolve some of the issues associated with measuring this relationship, or projecting how the two factors will interact in the future in GM. However, an introduction to some of the issues is presented here to inform future SEAP report iterations and increase understanding in GM.

3.2 De-Coupling Economic Growth and CO_2 Emissions

Historically, there has been a correlation between global economic growth and CO_2 emissions. This is shown by the fact that higher income countries tend to emit more CO_2 than low income countries and within a country, CO_2 emissions tend to rise during a boom and fall during a recession. For example, in the UK CO_2 emissions fell by 9.7% in 2009. The Committee on Climate Change argued that this was due to falling Gross Domestic Product (fall by 5%) and a rise in residential and industrial fuel prices (e.g. a rise in residential gas prices of 12%)[13].

Some countries, such as Sweden, Denmark and Norway claim to have achieved economic growth alongside reductions in CO_2 emissions. This is known as 'de-coupling' economic growth and CO_2 emissions. There are two types of de-coupling, known as 'relative' and 'absolute' de-coupling. Relative decoupling refers to a situation where resource impacts decline relative to the GDP; impacts may still rise but more slowly than GDP. Absolute decoupling is where resource impacts decline as GDP rises (Sustainable Development Commission, 2009).

As discussed in Section 1, GM aspires to achieving significant economic growth in the future and has set a target of reducing CO_2 emissions by between 30 and 40%. GM would need to achieve absolute decoupling to simultaneously meet the two goals.

It is possible that without action, GM's emissions would continue to rise. This would mean that if GM wanted to achieve its CO_2 reduction targets, GM would need additional actions to compensate for the rise in energy use and CO_2 emissions caused by economic growth.

However, it is difficult to conclude that economic growth in GM would necessarily result in an increase in CO_2 emissions and use of past global and country wide trends to predict trends for GM post 2010 would be overly simplistic. There may not be a direct correlation between CO_2 emissions and economic growth in GM in the future because:

1) **Economic growth, measured by GDP or GVA can occur for a large number of reasons that would not entail an increase in CO_2 emissions.** For example, the Manchester Independent Economic Review (AGMA, 2009) suggested that improving skill levels could play a major part in increasing productivity in GM. Improving skill levels could make businesses more innovative and competitive, increasing GVA with no resultant impact on CO_2 levels.

2) **Increase in consumption may not result in increased emissions in GM.** There is a simple correlation between income and consumption, as people earn more money they tend to spend it on more goods. However, standard approaches to measuring CO_2 emissions looks at where emissions occur, not where goods are consumed. Therefore, in theory a GM resident could buy a large amount of new goods and this would not increase GM's CO_2 emissions[14] because those goods are manufactured elsewhere and distributed using aviation and shipping (not counted in GM emissions). Indeed, if the trend towards relocating manufacturing plants to transition and developing countries continues, emissions could decrease in GM in the context of increasing consumption and increasing global CO_2 emissions[15].

[13] *Committee on Climate Change, 2010. Also, see http://bit.ly/bXQnOE to examine CO_2 emissions against GVA in countries across the world.*

[14] *There is an argument that in purchasing more goods a person would also consume more energy, e.g. through ownership of more or larger televisions, resulting in increasing CO_2 emissions. However, the authors were unable to source data to make a robust prediction on how energy use in the future might change as a result of this in GM for this SEAP report.*

[15] *Of course, where people choose to purchase goods that require energy this could increase energy use in GM. However, there is no guarantee that people will necessarily choose to spend their money on electrical appliances.*

This means that if CO_2 emissions are measured based on where goods are consumed, there is likely to be some correlation between economic growth and CO_2 emissions, but when emissions are measured by where they are emitted, it is harder to identify a necessary correlation, particularly over smaller geographic areas[16].

3) **Economic growth can reduce emissions.** In theory, GM economic growth could potentially reduce emissions by:

   a) Enabling people to buy more efficient goods (e.g. a more energy efficient fridge);

   b) Providing access to finance for renewable and low carbon technologies (e.g. to purchase a solar panel or insulate their homes); and

   c) Growth in the renewable and low carbon energy sector.

However, economic growth could result in an increase in CO_2 emissions in GM, to conclude that it necessarily would is considered to be an over-simplification in this context. It is recommended that data and studies be monitored to assess whether economic growth is likely to result in increases in emissions that need to be factored in, in later SEAP reports.

3.3 The GM Forecasting Model

The GM Forecasting Model (GMFM) has been developed by Oxford Economics to provide an independent model examining population, economic output (Gross Value Added) and employment, as well as wider issues such as skills demand, employment land, households and migration.

The GMFM produces projections of economic growth and detailed assessments of the existing economic climate within GM. The GMFM also has a CO_2 module that projects future CO_2 emissions based on economic scenarios (an overview of the GMFM methodology is provided in Appendix B). The GMFM CO_2 projections shown in figure 12 are based on the GMFM Accelerated Growth Scenario (AGS) to which GM aspires to. In this context the GMFM CO_2 emissions projection is used as a 'Business as Usual' (BaU) scenario to show the additional CO_2 reductions needed to meet GM Strategy target[17].

The GMFM CO_2 reductions do not consider the result of actions to reduce CO_2 emissions at the GM level, as it is a 'business as usual' scenario. However, the GMFM does assume some level of actions associated with continued energy efficiency actions. The methodology, therefore, does not enable its use as a 'do nothing' scenario as actions in this SEAP report would not necessarily be additive to those included within the GMFM.

Figure 12: GM Strategy CO_2 reduction projections and GMFM CO_2 BaU scenario

[16] *This is because generally the smaller the geographic area, the more likely it will be that products are purchased from outside the area.*

[17] *It should be noted that the original GMFM projections for CO_2 reductions used DEFRA original emission estimates, which were later revised by DEFRA. As the present study uses the latest DEFRA estimates, the GMFM CO_2 projections were normalised to enable comparison between these figures and GM Strategy targets.*

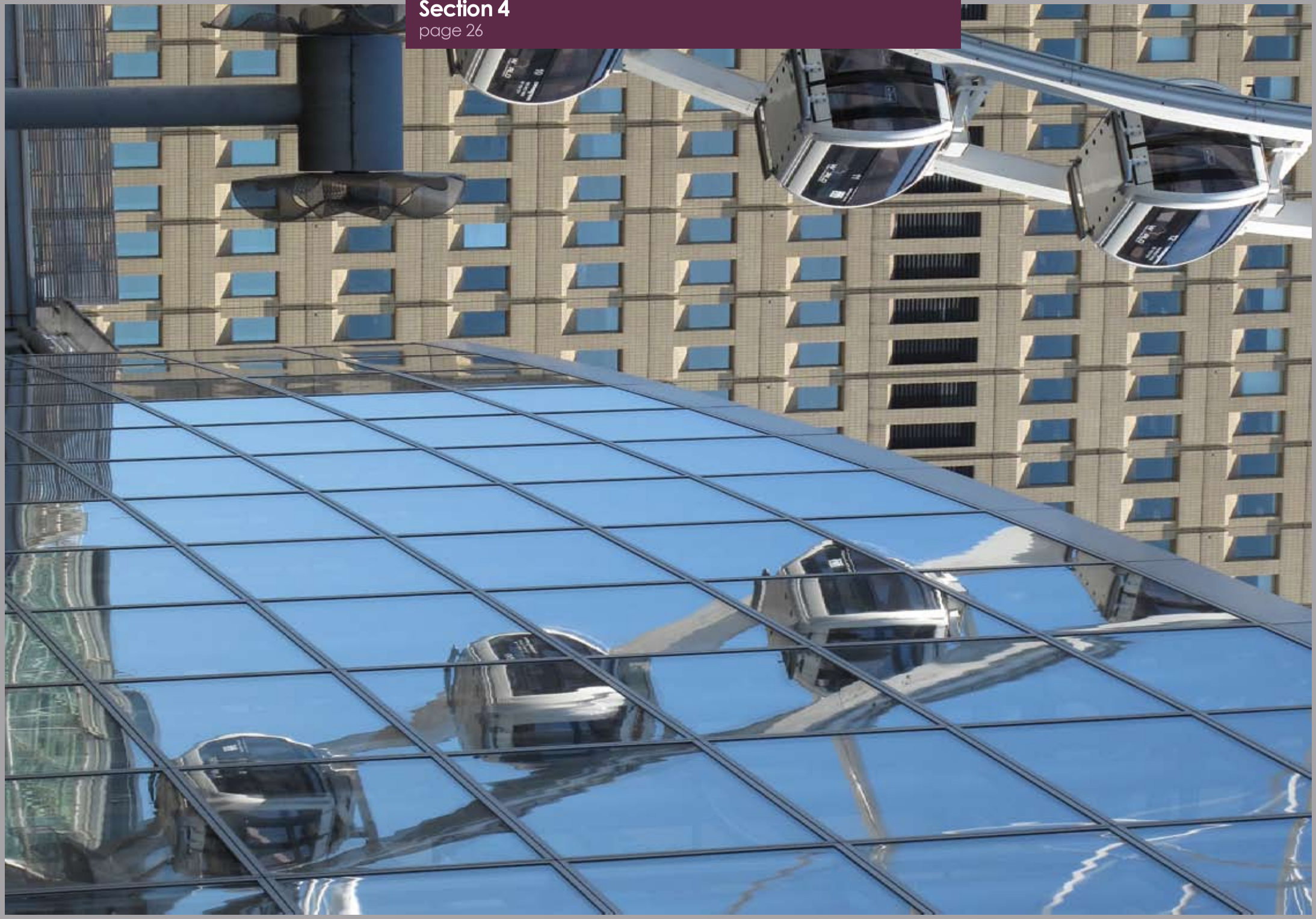
However, the GMFM model does provide an alternative scenario that could result if concerted action is not pursued at a national, regional, sub-regional and local level. The Manchester Independent Economic Review also provides a very useful and thorough review of the GM economy. However, as the MIER does not consider climate change or CO_2 emission reductions it is not reviewed further here.

Given the uncertainty around how economic growth in GM would affect CO_2 emissions, and the limitations of using the GMFM as a basis for examining the links between economic growth and no additional emission reductions have been proposed to compensate for an increase in emissions. Conversely, no reductions are assumed to occur in the absence of national, sub-regional and local actions described in this SEAP report.

3.4 Reducing CO_2 Emissions as a Driver for Economic Growth

The GMFM work shows the aspirations of GM and sets a framework for monitoring economic growth alongside CO_2 reductions. However, there is a very compelling argument that a rapid transition to a low carbon economy can not only happen in a presence of economic growth, but can support it. The Mini-Stern for Manchester (Deloitte, 2008) analysed the impact of legislation on a low carbon economy and demonstrated that up to £20billion may be lost to the economy up to 2020 if GM fails to respond effectively to the new and emerging legislative framework. As introduced in Section 1, rising energy costs due to peak oil and international and national financial mechanisms could mean that businesses competitiveness is affected by their ability to reduce their energy use and/ or obtain energy from renewable and low carbon sources.

Further, publications such as the Green New Deal report (New Economics Foundation, 2008) emphasises the economic opportunities for the UK associated with low carbon development. Shifting to green energy will produce new jobs and create more pound-for-pound investment. For example, analysis shows that the Low Carbon Economic Area for the Built Environment designation in GM alone could deliver up to £650 million additional Gross Value Added and support 34,800 jobs. Businesses who act now to develop low carbon solutions may be able to export these ideas to other areas of the UK and potentially abroad. Therefore, development of low carbon opportunities can support economic growth, conversely inaction could constrain growth.



Section 4
Setting Targets for Greater Manchester CO_2 Emission Reductions

4.1 Introduction

The targets and policy drivers for GM to reduce its greenhouse gas emissions are numerous and compelling. All national and international targets are derived from an attempt to develop emissions trajectories that keep the concentration of greenhouse gases in the atmosphere within limits that avoid the most damaging impacts of climate change (i.e. often considered to involve limiting a rise in temperatures to 2°C). Although there is little agreement on targets, there is an internationally recognised understanding of the likely consequences of atmospheric concentrations at different levels.

A full review of all international, national, regional and local targets is not provided here, although they have fed in to the development and analysis of national and GM actions in this SEAP report. Instead, the following section analyses some of the most important national and local greenhouse gas emission targets and puts these into context to propose sub-regional targets for GM. Analysis of regional targets has been excluded because of the new Government's planned abolition of Regional Spatial Strategies.

It should be noted that targets and actions can differ in terms of:

- Gases they examine (e.g. all greenhouse gases or just CO_2);
- Baseline year they measure emission reductions against (e.g. 1990 is used in the Climate Change Act, whilst 2005 is used in the GM Strategy); and
- Sources of emissions that are included in totals (e.g. aviation and shipping emissions are often excluded from targets).

This SEAP report focuses on CO_2 emissions, using a baseline year of 2005 and assuming that emissions from aviation and shipping are the same in 2050 as they are today. This assumption may be re-visited in future SEAP iterations as research continues.

4.2 Top-down: National Targets

4.2.1 What are the National Greenhouse Gas Emission Targets?

The UK Climate Change Act requires that the UK reduces its greenhouse gas emissions[18] by 80% by 2050 (over 1990 baseline[19]), which equates to a 77% reduction compared to 2005 levels (Committee on Climate Change, (CCC) 2008). Interim carbon budgets have been set to ensure the UK meets the 2050 target, including a target for a 34% reduction in greenhouse gases by 2020 (over 1990 baseline), which equates to 21% relative to 2005 levels (CCC, 2008). The new UK Government has stated an intention to call upon the CCC to assess the appropriateness of the current target against the latest available evidence. There is a distinct possibility that this could cause an upwards shift in the target towards, or even above a 40% reduction in greenhouse gas emissions by 2020.

4.2.2 What do Greenhouse Gas Emission Targets mean for CO_2 Reductions?

The UK's CCC concluded that we will need to reduce our non-aviation CO_2 emissions by 89% (over 1990 levels) to meet the 80% greenhouse gas emission reduction target. This increased figure is to compensate for the relatively modest reductions in aviation and international shipping, and a lower reduction in non-CO_2 emissions of 70%. An 89% reduction compared to 1990 would equate to an 88% reduction in CO_2 emissions compared to 2005 levels[20]. Using the same method, the target for CO_2 emission reductions by 2020 would be 34% compared to 2005 levels[21]. The most cost effective method of reducing CO_2 emissions will not necessarily be an 88% reduction in emissions from all sectors as some emissions will be easier or cheaper to reduce than others.

[18] *In this context, 'greenhouse gas emissions' refer to a basket of six key greenhouse gases, namely carbon dioxide, nitrous oxide, methane, hydroflourocarbons, perflourocarbons and sulphur hexaflouoride.*

[19] *The Climate Change Act '1990 baseline' means the aggregate amount of the net UK emissions of carbon dioxide for that year, and net UK emissions of each of the other targeted greenhouse gases for the year that is the base year for that gas.*

[20] *Using DECC, 2010, 'Statistical Release: UK Climate Change Sustainable Development Indicator: 2008 Greenhouse Gas Emissions, Final Figures'.*

[21] *As the target for a 34% reduction in greenhouse gas emissions by 2020 was set using an amendment to the Climate Change Act published in May 2009, a similar figure could not be located stating what this would mean for CO_2 emission reduction targets. However, if we assume that all emissions reduce at a steady rate over the time period this would entail a 38% reduction in CO_2 emissions to meet the 34% target.*

4.2.3 Other Relevant National Targets

There are a large number of other national targets relevant to the GM SEAP report; the following are some of the most relevant for this project:

- UK Low Carbon Transition Plan: 18% reduction in emissions compared to 2008 levels by 2020. 40% of UK's electricity to come from low carbon sources by 2020. Aims for 29% reduction in emissions from homes by 2020 and almost 100% reduction by 2050.
- Draft Heat and Energy Saving Strategy: Reduce UK CO_2 emissions by up to 44 million tonnes by 2020.
- Renewable Energy Strategy: 15% of UK's energy to come from renewable sources by 2020 (30% of electricity, 12% of heat and 10% of transport).

4.3 Bottom-up: Local and GM Targets

4.3.1 GM Targets

The GM Strategy sets a target for GM to reduce emissions CO_2 by 30-40% by 2020. This target suggests a similar reduction to the Climate Change Act but with a range rather than a single figure.

4.3.2 Local Targets

Each LA in GM is able to set its own targets for reducing CO_2 emissions, generating energy using renewable sources and contributing towards these two targets from new developments in their area. Consequently, there has historically been little consistency across GM in terms of targets set and little analysis of what the combined local targets would mean for GM.

In 2008 the Government introduced a set of National Indicators that they will use to measure the performance of local government. Local Authorities can choose which of these National Indicators they adopt and can set their own targets against those indicators. The two National Indicators relevant here are:

- **National Indicator 185:** CO_2 reduction from LA operations; and
- **National Indicator 186:** Per capita reduction in CO_2 emissions in the LA area.

In GM, eight LAs have adopted National Indicator 186, with seven having set targets for per capita CO_2 emission reductions in their area. Bolton has also adopted a target in its Core Strategy Publication document. Table 1 shows what these reductions would mean in terms of CO_2 emissions for GM[22] by projecting targets forward to 2020[23]. Manchester and Bolton have explicitly set CO_2 reduction targets for 2020 and 2018, so these have been included instead of projecting 2011 targets forwards.

[22] *As the timescales for these targets are relatively short, the population is assumed to be constant meaning that a reduction in per capita emissions equates to the same reduction in total emissions. More accurate analysis would take into account population change until 2020 in each LA area.*

[23] *This is purely illustrative as National Indicator targets are not set for 2020 and it may not be easy for LAs to continue to reduce CO_2 emissions at the rate that they planned to until 2010/11.*

Target $C0_2$ Reduction Targets						
	Target Source	% Target reduction 2010/2011	% Projected Target to 2019/20 using 2010/11 Targets	Emissions in Target Year (tonnes)	% Reduction of GM emissions achieved by 2011	% Reduction of GM emissions achieved by 2020
Bolton	Core Strategy	10	31	1617	1	3
Bury	NI186	Baseline and targets to be agreed				
Manchester	NI186 (and MCC Climate Change Action Plan)	11	41	2970	2	8
Oldham	NI186	12	48	1188	1	4
Rochdale	NI186	10 (of which 3 from local initiatives)	39 (of which 13 from local initiatives)	1187	1	1
Salford	NI186	13	50	1431	1	4
Stockport		11	48	1186	1	5
Tameside		12 (of which 5 from local initiatives)	48 (of which 22 from local initiatives)	1235	1	4
Trafford	NI186	9	37	1953	1	6
Wigan	No target set for LA emission reductions					
Total					9	33
Total Assuming Average Reduction by other LAs					12	42

Table 1: % CO_2 Reduction in GM Resulting from Individual LA Targets

The table shows that if the seven LAs who have adopted National Indicator 186 (plus Bolton) continue to ramp up their targets until 2020 and meet these targets, this will result in a 33% reduction in CO_2 emissions in GM. This target is a bit misleading because it looks at what eight LAs would achieve for the whole of GM and would result in very high targets for some LAs (e.g. extrapolating Salford's target to 2020 results in a 50% reduction by 2020 which may not be realistic or equitable). Therefore, these targets are presented only to demonstrate the need for all LAs to adopt targets and to represent what current targets would achieve if continued. If the other two LAs set targets at an average of the targets above, this would result in a 42% reduction in CO_2 emissions by 2020.

In other words, if the other two LAs do not reduce emissions, even the projected emission reductions above would not result in a 34% reduction in CO_2 emissions in GM. However, if the current National Indicator targets are ramped up to 2020 and the other LAs set similar targets, these would exceed current national and sub-regional targets.

4.4 Future Considerations for Target Setting in SEAP Reports

4.4.1 Cumulative Emissions Versus Target Year Emissions

The key issue in mitigating climate change is reducing total greenhouse gas emissions over the next forty years, not just reducing them in one particular year. In simple terms, if human activity continues to emit greenhouse gases at the same rate until 2019, then reduced CO_2 emissions by 34% the impact on the climate will be larger than if GM reduces its emissions by 20% now and keeps emissions at this level until 2020. To retain consistency with existing approaches, the GM SEAP report currently uses a year based target, however cumulative emission targets could be developed in future SEAP reports. Significant thought leadership in this area has been demonstrated by local institutions such as the Tyndall Centre, Manchester.

4.4.2 Targets by Sector

It will be easier and cheaper to reduce emissions from some sectors than others. This is clearly shown in later sections when we have projected potential CO_2 emission reductions resulting from different types of actions. The CCC (2008) produced projections using the UK MARKAL (MARKet Allocation) model, which sets out the least-cost optimisation model for energy use. It imposes a cap on overall CO_2 emissions and then sets out the emission reductions that could occur in each sector to produce scenarios for ways to meet a CO_2 reduction target.

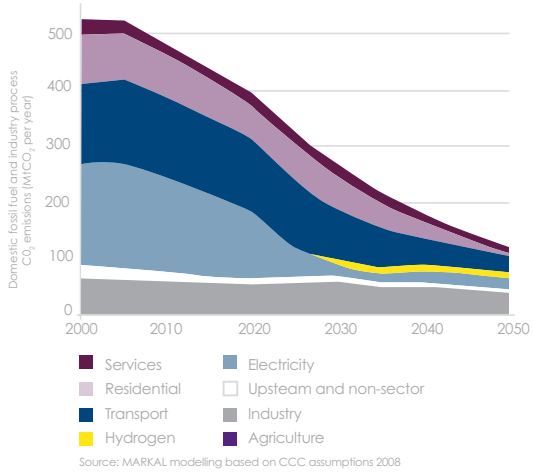


Figure 13: MARKAL Model Projections to meet 90% Reduction in CO_2 Emissions by 2050

The Tyndall Centre Manchester has done significant, internationally recognised work in this area, and developed a similar projection looking at sector based reductions to meet a Manchester City Council target for 41%. This is presented in Figure 14.

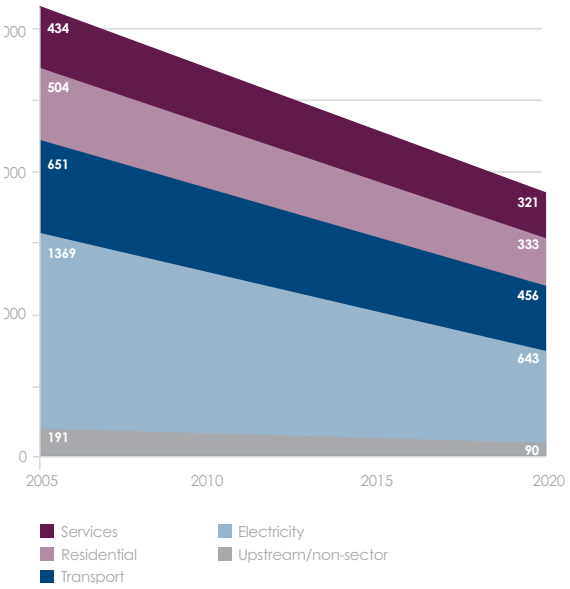


Figure 14: Tyndall Centre CO_2 Emission Reductions by Sector (kt CO_2 /year) to meet a 41% Manchester City Council Target (Extracted from the Manchester Climate Change Action Plan)

Further projections of how GM could meet a 90% CO_2 reduction target was completed as part of the baseline work for the SEAP report using the Greenhouse Gas Inventory Protocol's (GRIP) scenario process[24]. This research provides some alternative scenarios on how GM could meet its CO_2 reductions targets. It is possible to suggest that higher or lower CO_2 emission reductions are required for a given sector based on which sector can deliver the fastest, cheapest, easiest, CO_2 reductions with the least adverse impact on a public 'good'. However sector based targets are deemed a political decision and sector targets are not provided in this SEAP report.

[24] *The GRIP report is titled "Developing Future Energy Scenarios for Greater Manchester" report produced by University of Manchester and Carbon Captured - March 2010. The report is available to download from Manchester is My Planet website manchesterismyplanet.com.*

4.4.3 Holistic Approach to Emissions (Embodied Energy, Aviation and Shipping)

The report and targets all focus on emissions where energy is used, rather than where a product is consumed. For example, emissions associated with manufacturing a television purchased in GM (i.e. the televisions embodied energy) would be attributed to the manufacturing area (e.g. China) rather than GM. This approach is in line with current standard international, national, regional and local approaches to measuring CO_2 emissions. However, this approach is a global source of contention as it means that developing countries, at the low end of the production line for the global economy, are asked to take responsibility for, and reduce emissions from products manufactured for the developed world. This is viewed by some as being inequitable or inaccurate.

Approaches such as carbon footprinting can take an alternative approach whereby the emissions from a person, development or area includes the embodied carbon in the products it consumes. Manchester's Climate Change Action Plan (Manchester City Council, 2009), for example, considers that Manchester should incorporate embodied carbon in its CO_2 reduction targets and consequently sets a commitment to create a Total Carbon Footprint framework by 2013. This approach could also be considered in later SEAP reports, particularly if changes to policies and legislation at the international and national level move towards this approach.

Finally, it is likely that in the near future agreement will be reached on ways to attribute emissions from international aviation and shipping to countries, and potentially further to regions or sub-regions. Changes in this arena should be monitored and it may be considered appropriate for GM to consider international aviation and shipping emissions in future SEAP reports.

4.5 Conclusion

Overall, the analysis of national, sub-regional and local targets suggests that when all targets are translated to a common baseline, the following targets would be suggested:

- **Climate Change Act:** 34% by 2020 and 88% by 2050
- **GM Strategy:** 30% - 40% by 2020
- **LA Targets:** 42% by 2020 (assuming the remaining 2 LAs adopt similar targets to the eight authorities who have set targets and all targets are increased to 2020. This is a large assumption.)

The majority of stakeholders involved in the workshops for this project suggested that we should use the top-down Climate Change Act target of 34% by 2020. However, some stakeholders suggested that we should seek to exceed this target towards a 40% reduction. Emphasis was placed on the need to disaggregate this target down to the LA level in a transparent manner.

Although the three methods of generating targets are divergent in their totals, it should be noted that all targets fall within the GM Strategy range. As it has not been possible to identify conclusive socioeconomic or other evidence to suggest that on balance GM should reduce CO_2 emissions by less than other areas of the UK, it is suggested that a target for GM should aim for the higher part of this range (between 34% and 40%). However, there may be a case to suggest that accelerated carbon reduction may create local market conditions to accelerate the growth of GM's green economy, in which case a higher target could be set. Due to the variation in target years and approaches across GM, a notional target of 34%, directly mirroring the national target, has been used as the target for modelling in this SEAP report.

Section 5
Introduction to Actions to Meet CO_2 Reduction Targets

5.1 Introduction

Chapters 6-12 discuss existing and proposed national and GM actions to meet the proposed 34% CO_2 reduction target for GM. A table summarising all actions and identifying potential actors to take forward actions is provided in Appendix A. The table will need to be completed through partnership working to identify and agree actors and timescales for each action and the suggestion of actors is merely provided as a starting point to aid discussions.

This document places all potential actions to reduce CO_2 emissions on a single baseline, providing information about potential CO_2 reductions in a manner that enables actors to compare actions against one another. Reductions were established by estimating a theoretical maximum for that intervention, then estimating the realistic potential savings that could be achieved by 2020 and 2050. Each calculation is based on the best available information for that intervention. Baseline information available to carry out analyses varies considerably between sectors and actions and therefore assumptions and projections, should be re-visited in future SEAP reports as further research emerges.

Whilst efforts have been made to conceptualise actions in a way that means that the impact of each action on CO_2 emissions will be additive (i.e. each action would have an additional impact compared to all other actions), there are clearly interrelationships between actions that will influence the total CO_2 emission reductions achieved. For example, if the national government succeeds in rapidly decarbonising the grid, the additional carbon savings achieved through electricity efficiency measures will be smaller than if the grid remains CO_2 intensive. Where possible, these interrelationships should be considered when implementing actions.

5.2 Understanding SEAP Report Actions

In conceptualising actions for GM, it is important to explain how the following sections are structured. Each section is structured to provide an overview of:

- **Potential Actions:** Exercise quantifying the CO_2 reductions that could result from different potential actions[25]. For consistency, % reductions are shown as reductions in overall GM emissions, not a percentage reduction of that sector, unless stated otherwise. Potential actions are separated into:
  - **Potential National Actions:** Actions likely to occur without GM intervention. These contributions are subtracted from GM targets. Where actions can support national actions these are discussed.
  - **Potential GM Actions:** These are actions that GM have control over and could bring forward. Some GM actions will also require national support.
- **What is Happening Already in GM:** Summary of some of the actions that are already being undertaken/ planned in GM.
- **Recommendations for Action:** Recommendations on priority actions for GM based on the quantification of actions, baseline research and stakeholder engagement. This focuses on priority actions, and is therefore not a comprehensive list of everything that could be carried out. There are two types of actions:

Enabling Action

These are actions presented in purple boxes and are actions that enable the achievement of primary action.

Primary Action

These actions are presented in green boxes and are those actions that would directly reduce CO_2 emissions.

[25] *Estimates have been generated through first developing 'theoretical maximum' CO_2 emission reduction that could result from an action, then qualitatively assessing the 'realistic potential' for that intervention in GM. The second stage takes into account existing knowledge about opportunities and barriers to that intervention. However, the viability of technologies is likely to change significantly over time so these figures will need to be re-visited in future SEAP iterations.*

Figure 15 presents a diagram showing the relationship between different types of actions in this SEAP report.

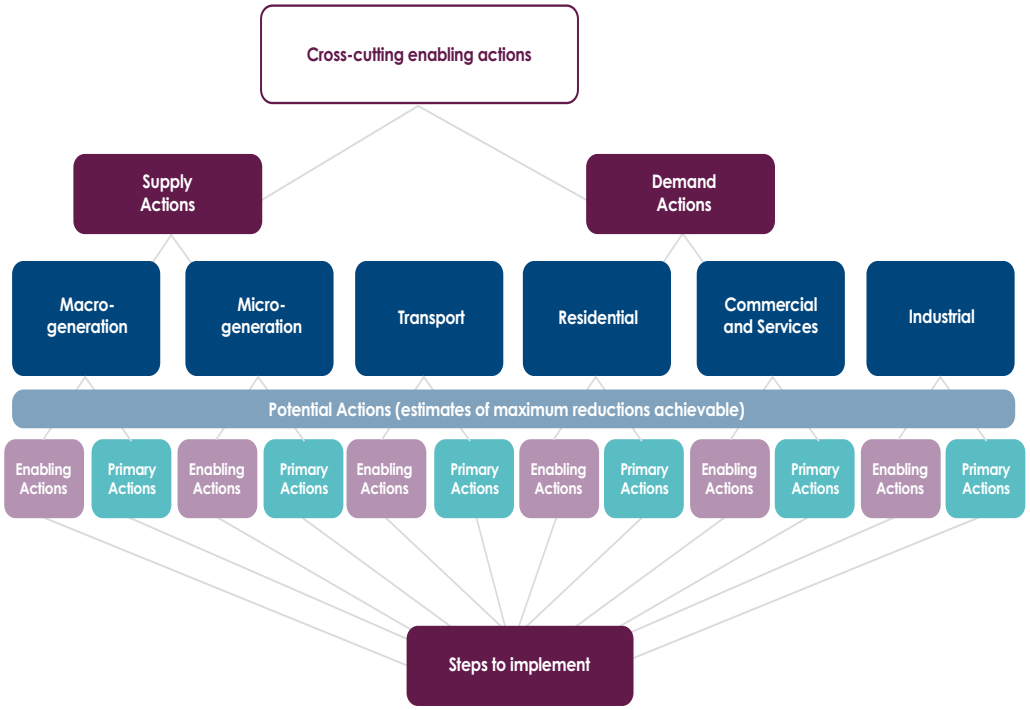


Figure 15: Diagram Showing Categories of GM SEAP report Actions

Section 6
Cross-Cutting Enabling Actions

6.1 Introduction

The actions to enable and support the delivery of a sustainable energy system in GM cut across sectors and so are summarised below as cross-cutting enabling actions.

6.2 National Enabling Actions

As discussed in section 2, the national policy, governance, planning and funding context is set to change dramatically in the wake of the new Coalition Government formed in May 2010. These changes may provide a range of opportunities for GM and a number of formal and informal consultation and engagement opportunities are available. Given the current state of flux, this SEAP report does not attempt to summarise potential changes over the next five years.

6.3 What is Happening Already in GM?

6.3.1 Governance and Partnership Building

GM is one of the two pilot statutory city regions announced by the outgoing Government in the 2009 budget. AGMA is the voice of the ten LAs in GM, working in partnership with a wide range of private, public and voluntary organisations in and around GM. GM has the opportunity through AGMA to reshape how central Government and national organisations implement shared energy goals. GM can also use its resources and the collaboration of funding, resources and energy of AGMA's member organisations and partners, to shape its own destiny. Significant steps have been taken in developing partnership arrangements with democratically accountable local governance structures that could enable the implementation of actions that can result in CO_2 reductions in GM.

The steps include:

- **Establishing the seven AGMA Commissions**[26]
- **Setting up the AGMA Energy Group:** A cross-sectoral group of key stakeholders including elected Members that reports to AGMA Executive via the Environment Commission It has been established to lead the development of GM's energy agenda on behalf of AGMA.
- **Development of Capacity and Resources to Support the Environment Commission and Associated Workstreams:** A core team of 4 has been established, supported by a wider network of more than 20 people, with work to develop a more substantial resource to support GM in delivering its low carbon goals at an advanced stage.

The development of the AGMA Energy Group, in particular, may provide a body capable of harnessing power and resources devolved as part of the new Government's proposals to increase local decision making. It could potentially form the core of a model for how funds such as Supplier Obligation and energy transformation could be deployed in a more efficient, and locally relevant and accountable way.

6.3.2 Funding and Finance

There is some understanding from various stakeholders of the opportunities to obtain funding for schemes to reduce CO_2 emissions. The challenge is ensuring that stakeholders applying for funding have access to this expertise. The Low Carbon Economic Area for the Built Environment (LCEA)[27] programme may have a role in establishing the capacity needed to co-ordinate and obtain funding and finance for actions in some sectors.

[26] *These seven Commissions are: Commission for the New Economy, Planning and Housing Commission, Transport Commission, Environment Commission, Health Commission, Public Protection Commission and Improvement and Efficiency Commission*

[27] *GM was designated as the UK's Low Carbon Economic Area for the Built Environment in December 2009, one of eight LCEAs nationally.*

6.3.3 Research and Skills Development

The Joule Centre for Energy Research and Development (henceforth the Joule Centre) is a partnership of North West Universities, commercial organisations and other stakeholders associated with the energy industry. The vision of the Joule Centre is:

"To create a world-leading energy research centre in England's North West which will significantly increase the region's research capabilities in sustainable energy technologies and energy systems"

This existing partnership of stakeholders can help in the development of research and skills within GM and provides an existing forum for discussion on future energy directions. The Joule Centre can capitalise on the regional knowledge base in both academia and industry to develop an innovative research and development agenda that will support the work of the Northwest Energy Council and exploit opportunities in energy systems and technology development that are pertinent to the North West in general and GM in particular.

The Corridor Manchester Partnership[28], with the LCEA programme[29] and the Joule Centre aims to establish the Manchester Low Carbon Laboratory. The Laboratory could assist in research and skills development to support other GM actions and test emerging ideas and technologies. The Laboratory could facilitate development of a robust information-sharing network on the design, deployment and operation of new, cutting-edge technologies and employment practices.

6.3.4 Development of Supply Chains for Low Carbon Technologies

Envirolink Northwest[30], the North West Regional Development Agency[31] and Enworks[32] are working to improve the competitiveness of the North West region's energy, environmental technologies and services sector.

The three organisations, amongst others, are helping to identify, co-ordinate and support the development of supply chains for low carbon technologies. The LCEA programme could also provide support to develop the supply chain for retrofitting technologies.

6.3.5 Planning for CO_2 Reductions

Planning has an important role to play in minimising CO_2 emissions from new developments and significant refurbishment projects. GM has invested significant resources in the development of an evidence base to support planning policies on renewable and low carbon energy. The DES (Urbed, Aecom and Quantum Strategy and Technology, 2009), in particular, provides evidence to support planning policies on energy. One key recommendation from this report is that GM could develop an Energy Spatial Plan as a core component of its wider energy strategy that could help support development of a consistent planning framework to support renewable and low carbon technologies.

Since completion of the DES, the following actions have taken place to support planning policies on energy:

- Manchester, Bury and Stockport have identified strategic energy opportunity areas, where particular approaches and/or technologies could be pursued[33];
- A questionnaire has been issued to all LAs on their current work on energy planning and the role AGMA can have in supporting LAs;
- Skills based workshops have been held to build capacity to enable planners to set supportive planning policies and effectively deal with planning applications that could incorporate renewable or low carbon energy generation;
- Discussions have continued on the development of an Energy Spatial Plan;
- Individual LAs are carrying out their own, more detailed energy studies to support planning policies; and

[28] *The Corridor Manchester Partnership includes Manchester City Council, the University of Manchester, Manchester Metropolitan University and Central Manchester University Hospitals NHS Foundation Trust.*

[29] *The Low Carbon Laboratory is also supported by key stakeholders, including Bruntwood, Manchester Science Park and Arup, all of which contribute considerable expertise and resources.*

[30] *Envirolink Northwest is the energy and environmental technologies and services (ETS) sector development organisation in England's Northwest.*

[31] *The NWDA's core purpose is to maximise the region's competitiveness to build a stronger economy by, amongst other actions, supporting the region's businesses, assisting new start-ups and encouraging investment.*

[32] *Enworks is the Northwest's environmental business support service.*

[33] *Some work was undertaken looking at identification of strategic energy opportunity areas in all ten LAs in the DES, but these three LAs are the ones known to have taken these recommendations forward to date.*

- A landscape capacity study for wind energy developments has been carried out for six planning authority areas, including Bury and Rochdale.

LAs in GM have also been proposing planning policies that aim to increase the energy efficiency of new and refurbished buildings. These policies could also have a significant impact on the CO_2 emissions from new buildings.

It should be noted that new developments will only result in a reduction of CO_2 emissions in GM if they are accompanied by the demolition or disuse of buildings that were less energy efficient. If developments result in an increase in the total number of buildings, then the most that planning can achieve is minimising increases in CO_2 emissions from buildings. Therefore, it should be recognised that planning has a very valuable and important role to play in meeting GM's CO_2 reduction targets, but that planning approaches will need to be pursued with a wealth of measures to address issues with the existing building stock to achieve GM's CO_2 reduction targets.

6.3.6 Private Sector Action

The businesses and private sector organisations of GM, like its residents, are known for their innovation. Throughout GM private sector organisations have been engaging in actions to reduce the CO_2 emissions from their activities. The SEAP report could not claim to capture even a significant proportion of these actions. However, the following high profile examples of private sector actions are provided to illustrate the types of actions being pursued:

- Co-operative Insurance Tower was clad in photovoltaic panels and began feeding electricity into the grid in 2005;
- Manchester Airport is working towards become carbon neutral for energy use and vehicle fuel by 2015;
- Heineken UK opened a new biomass plant at Royal Brewery in Hulme, Manchester in 2009; and
- Businesses and Organisations along Corridor Manchester are pursuing a large number of actions to secure a low carbon future.

6.4 Recommendations for Action

6.4.1 Political and Administrative Structures to Deliver, Monitor and Take Forward the Sustainable Energy Action Planning Process

During consultation for this project, stakeholders acknowledged and supported the development of this SEAP report and the benefits of cross-boundary working on energy planning. The following issues will need to be addressed in the development and maintenance of political and administrative structures to support implementation of SEAP report actions:

- The need to secure buy-in from national, regional and local Government to implement actions.
- A current lack of clarity about the roles of different regional, sub-regional and local bodies in and around GM in delivering actions on energy.
- A lack of knowledge about what is currently happening in GM and how to access expertise on energy related topics; and
- A need to ensure that there is a body with the power and resources to co-ordinate action on energy in GM and carry out some of the cross-cutting actions in this SEAP. The new Government may provide opportunities to open discussions with about delivering more power and resources for GM.

Enabling Action

Develop political and administrative structures to aid co-ordination and delivery of SEAP actions.

The following actions are suggested to help develop political and administrative structures for delivery:

1). **Identify a body that will co-ordinate SEAP report actions** and potentially deliver some of the cross-cutting actions. This body would need identified resources and funding, ring-fenced for co-ordination and delivery of actions on energy. Therefore, this action is strongly related to actions on obtaining funding and resources.

This body could potentially form part of:

a) Environment Commission;

b) Energy Group: Potentially involving dedicated task groups with one or two key staff responsible for overall co-ordination; or

c) New cross-cutting agency (e.g. Climate Change Agency): This would require funding for establishment of the agency itself as well as co-ordination of the sustainable energy action planning process and delivery of actions.

2). The co-ordinating body should **identify an actor for each action** in this SEAP report and obtain buy-in from the lead actor to ensure the organisation or body is happy to organise delivery of the action. A simple diagram should be developed to illustrate actors and roles.

3). The co-ordinating body should carry out a **mapping exercise of existing expertise** on energy systems and technologies in GM. For example, the exercise could identify academics (e.g. aided by Joule Centre), existing networks (e.g. networks supported by Envirolink), advice centres (e.g. Energy Savings Trust and Carbon Trust), regional support (e.g. Northwest Development Agency) and LA experience (e.g. Stockport on hydro-schemes).

4). The co-ordinating body should **monitor and evaluate** the success of GM in delivering SEAP report actions and CO_2 emission reductions. This information should be published, providing a concise overview of what is happening in GM to reduce CO_2 emissions. This can facilitate information sharing, let people know who might be contactable for assistance and publicise progress.

5) All of the above should be communicated by the co-ordinating body.

6) The co-ordinating body should engage in discussions with national government over development of a single funding pot for delivery of SEAP report actions and/ or more control over future resources for GM.

A second cross-cutting enabling action will be to finalise how this SEAP report will affect LA documents and approaches to energy and CO_2 reductions.

Enabling Action

Agree on relationship between SEAP and LA documents and approaches.

This could be implemented by:

1). **Agreeing how the SEAP report will support LA target setting**, actions and monitoring. This could be completed in three different ways:

a) Bare minimum approach: Agreement on metrics for target setting and measurement and which actions LAs will take responsibility for delivering;

b) Medium approach: All of the above and LAs endorse the SEAP report and use metrics, frameworks and ideas on actions to shape their own strategies.

c) Strong approach: LAs decide to develop their own SEAP reports using the GM SEAP report as a framework. Potentially involving securing money from European funding pots.

2). Use the above to ensure that a consistent approach is followed to setting targets in LAs across GM. This will include:

a) Agreeing common metrics for measuring CO_2 emissions across GM;

b) Encouraging LAs to explicitly set targets for 2020 using a 2005 baseline;

c) Ensuring LA targets would cumulatively achieve GM targets; and

d) Consider if there would be merit in developing LA level SEAPs.

The co-ordinating body will need to secure buy-in from LAs into one of the approaches above. Consequently, it is suggested that the focus initially be on the 'bare minimum approach', with consideration given to bidding for funding to extend this approach.

The economic benefits of actions have been taken into account when developing actions and identifying top priority actions in Section 15 and Appendix A. Ways to encourage economic growth through the implementation of actions have also been included on an ad hoc basis. However, a thorough analysis of how each action can be implemented to encourage economic growth has not been carried out.

It is recommended that analysis of this nature can help ensure that actions support, rather than hinder economic growth. This will help support a 'win-win' situation where actions reduce CO_2 emissions and support economic growth.

Enabling Action

Develop an assessment approach to examine how actions can be implemented in a way that maximises the economic benefits of actions for GM.

This action could be implemented by developing an assessment approach that can assess how the economic benefits of actions can be maximised for GM.

Enabling Action

Develop and implement a robust approach to, and programme of, national government engagement aligned with key consultation opportunities and legislation development timelines.

To implement this action, it is suggested that GM should consider using its influence and leverage in the following areas:

1). Put itself forward as a centre of learning and development in the field of Smart Grids and smart metering;

2). Seek to ensure that the work undertaken for the Low Carbon Economic Area (Built Environment) project is captured during the suggested restructuring of commercial and domestic support agencies and arrangements;

3). Identify and reflect the national changes to spatial planning frameworks to ensure that GM makes best use of emergent flexibilities to set locally accountable standards for energy generation, distribution and building energy performance within GM strategies and frameworks;

4). At all times, robustly advocate a strong and specific floor price for carbon associated with strict 'total carbon footprinting' validation, a substantial feed in tariff, strengthening, integration and early introduction of Renewable Obligation Certificates and incentive arrangements for both power and heat; and

5). Introduce a requirement for all organisations generating waste heat beyond a certain limit to have identified and secured heat utilisation solutions within a specific timeframe, and for all new heat generating installations to be accompanied with heat utilisation technologies.

The use of Sankey diagrams to develop an overview of an area's energy system is relatively novel in the UK, and has proved helpful to a number of stakeholders. Therefore, the continuation and expansion of the Sankey diagram is recommended as part of the process to monitor and develop future SEAP reports for GM.

Enabling Action

Take forward the Sankey diagram methodology as a monitoring tool.

In taking forward the Sankey diagram methodology, it could be extended to incorporate new factors such as investment and cost flows.

Finally, in future SEAP report iterations, the methodology should be revisited to test whether the approach should be modified on the basis of emerging information or changing contexts which allow for different ways of measuring CO_2 emissions.

Enabling Action

Revisit the SEAP report methodology during the next SEAP report review and consider whether alternative or additional methods are appropriate for measuring CO_2 emissions in the changing context.

This could be implemented by re-visiting assumptions in the next SEAP report, including considering whether:

- Targets should be set by sector;
- Measures for GM emissions should include aviation and shipping;
- The approach should be shifted to focus on where products are consumed, rather than where they are manufactured, including consideration of embodied energy;
- Approaches should look at cumulative emissions rather than set targets for a certain year in the future; and
- Assumptions about future energy use should be revisited to, for example, examine whether energy use is increasing as a result of economic growth, population increases or climate change[34].

6.4.2 Planning for CO_2 Reductions

The DES and subsequent LA studies provide evidence and recommendations on planning approaches to energy and this detail will not be replicated here. However, it was considered worthwhile highlighting two key actions for the planning system.

Enabling Action

Develop a consistent approach to spatial planning for energy across GM

This could be taken forward as an Energy Strategy, potentially including a statutory Energy Spatial Plan. Amongst other features, the Strategy could:

- Set out targets for emissions from new developments;
- Explore LA wide targets and examine how these targets aggregate to meet the GM target; and
- Set out a consistent approach to dealing with applications for renewable and low carbon energy developments.

If the new Government decides to abolish all Regional Spatial Strategies (RSS), there may be an increased role for a statutory Energy Spatial Plan that, for example, included targets for renewable and low carbon energy formally contained in the RSS. A consistent approach to energy in local planning policies will also be important to deliver energy actions. Actions are well underway to deliver this.

Enabling Action

Investigate ways to support the development of renewable and low carbon energy developments that currently have difficulty obtaining planning permission

For some technologies, particularly wind turbines and Energy from Waste plants (EfW), the main barriers to implementation are political rather than technical. One enabling action could be to investigate how developments might be supported and/ or provide clarity on the chance of an applicant's success. A large component of this is likely to involve conversations with national government on how to speed up the planning process for large energy generation projects. However, work within communities will also be needed to ensure that a balance between local amenity and community needs is reached.

6.4.3 Funding and Finance for Actions

Obtaining finance for implementing actions is fundamental to delivering a sustainable energy system for GM. Harnessing existing understanding of funding and finance opportunities and ensuring that actors have access to expertise to assist in applications will be the challenge for GM going forward.

The following issues were identified with regard to funding and finance in GM:

- 'Seed' funding is often required to provide initial capital for infrastructure and obtaining national government funding may be difficult in the future;
- There is a lack of knowledge about funding opportunities;
- It is often difficult for organisations to complete funding applications because:
  - It is difficult to obtain information on new technologies (e.g. CO_2 reductions per £ for triple glazing)
  - There are no known sources of easy to access information to support applications (e.g. on photovoltaic supply chains).

[34] *As a result of unavoidable climate change it is likely that energy use in the future may reduce in the winter (as a result of milder winters) and increase in the summer (as a warmer summers and consequently increasing needs for mechanical ventilation). Whether this would result in a net increase in energy use is uncertain, but should be considered in future SEAP iterations when more evidence may be available.*

- Actors delivering actions do not always have the skills to complete applications; and
- Funding applications can be time consuming and expensive to complete. Justifying this time and expense may be more difficult in the private sector and/or when associated with the delivery of 'risky' new and emerging technologies.

The issues and challenges identified and the skill sets needed to address them very closely mirror the sorts of skills and capacity shortages identified in the LCEA work for GM. Therefore, a pooled resource for assisting in identifying and obtaining finance and funding for the LCEA and energy work could be the most efficient means of resolving the issues above.

Financing schemes that could be considered include:

- **Revolving Funds:** A 'revolving' fund for a set of investment projects that aims to become self-sustainable after its first capitalization.
- **Leasing:** The client makes payments of principal and interest to the financial institution. The stream of income from the cost savings covers the lease payment.
- **Energy Services Companies (ESCos):** A private sector ESCo usually finances the energy saving projects, with the investment costs recovered with profit from the energy savings achieved during the contract period.
- **ESCo Intracting Model or Public Internal Performance Commitments:** A public sector ESCo called 'Intracting model' or Public Internal Performance Commitments (PICO) has mainly been used in Germany. In the PICO model a department in the public administration acts as a unit similar to an ESCo in function for another department.
- **Public Private Partnership:** In this case the LA uses a concession scheme under certain obligations. For instance, a LA promotes the construction of a zero emissions swimming pool by allowing a private company to run it using the profits to repay the initial investment.

Enabling Action

Develop support mechanisms to enable actors to obtain funding for SEAP report actions

The following steps are suggested to implement the action above:

1) **Identify a body to assist in gaining funding for GM SEAP report actions**, potentially drawing on the LCEA and/ or the Energy Group funding task and finish group. This body would then need to review SEAP report actions and begin the iterative process of identifying potential funding sources for each action where funding has not yet been secured.
2) Engage with Europe and national government to determine whether the funding body identified in step 1 can take **more control over funding for GM** to negate the need for num erous funding applications and enable more local control over actions.
3) **Collate information about existing and future funding mechanisms** for projects and make this information available to stakeholders.
4) **Seek a transfer in emission reduction funding** (e.g. Supplier Obligation) from Energy Companies to Local Government led partnerships to explore the potential to act as a trial and test bed area for innovative energy supply pricing arrangements, including the use of distribution network standing charges.
5). Provide **support to organisations developing funding applications** through one or more of:
    a) Running a short workshop on how to apply for funding;
    b) Providing a question and answer facility to support organisations when they are applying for funding; and/ or
    c) Developing a database of information to inform funding applications and a guide to locating difficult information, potentially by inviting feedback from stakeholders who have recently submitted funding bids.

6). Utilise research and recommendations in the DES and subsequent LA studies to determine whether **planning can secure funding for energy actions.** For example, this could include:

a) Policies requiring contributions through Section 106 agreements for infrastructure directly related to the site (e.g. connection to a district heat network);

b) Policies requiring on-site renewable or low carbon energy generation with 'allowable solutions' for developments or locations where on-site generation is not viable or better solutions can be sought elsewhere; or

c) Use of the Community Infrastructure Levy, or similar 'roof-tax[35]' type interventions to gain funding for priority energy projects. This could include some kind of energy tariff to fund priority projects.

In pursuing any of the above actions, it should be recognised that any funding sought from developers through the above agreements could increase costs for developers and consequently impact on purchase/ rental prices, the provision of other public goods or the quality of the development. This should be taken into account when deciding on an approach to gaining funding through planning.

6.4.4 Delivery Vehicles for Projects

It is suggested that a delivery vehicle for an action should not be developed until there is a defined project to deliver. This is because organisations like ESCos can work most efficiently when they are given a particular project and asked to deliver it, rather than being expected to invest in project development. Often the nature of the delivery vehicle will depend on the specifics of the project, making it more difficult to develop generic ESCos, for example. Therefore, delivery vehicles will be considered as part of plans to implement primary actions. A large number of special purpose vehicles could be considered to assist in delivering projects, including a variety of public and private partnership arrangements.

6.4.5 Supporting Research and Innovation

The development of technologies to reduce CO_2 emissions is a fast moving field and those areas that are able to capture new technologies, foster innovation and capture it for businesses could support job creation and economic growth in the transition to a low carbon economy. There are a large number of potential innovative technologies that could be researched in investigate their applicability to GM in the future, for example:

- Capturing energy from transport;
- Development or encouragement of smart appliances (e.g. electricity powered hot water storage systems which charge when the wind is blowing or washing machines that wait until the energy costs are low); and
- Capturing heat from people (e.g. from busy stations).

There is also a large amount of research and knowledge in universities that could be captured to inform interventions, for example, recent research has been carried out on community engagement, small-scale intelligent energy generation[36] and reducing emissions from aviation (e.g. see Wood et al, 2009).

[35] *A 'roof-tax' is the name used to refer to a mechanism that requires a fixed fee from a particular type of development (e.g. developments of over 10 houses) for community infrastructure throughout a LA area. The term was first coined to describe the Milton Keynes infrastructure tariff. The Community Infrastructure Levy is an attempt to formalise this approach.*

[36] *The Market Access for Smaller Size Intelligent Electricity Generation (MASSIG) project is currently looking at ways in which small scale generators can access markets. The investigation encompasses aggregators and virtual power stations with the final report due later in 2010.*

Enabling Action

Support research and innovation in both Universities and businesses in GM.

To deliver this action, it is suggested that the co-ordinating body organise a meeting with potential University partners to identify areas where research could be developed to reduce CO_2 emissions in GM, particularly where research could be used by businesses in GM and also support economic growth. There may also be opportunities to put together joint bids for funding for research into innovative technologies and for the development of 'test' projects or case studies. Opportunities to develop and capture research to foster innovation could be discussed at this meeting, with discussions around how actions might support the actions in this SEAP report, but also what research could be developed to inform future actions. An approach could also be developed to targeting key businesses in GM who might be interested in adopting innovative ideas and who could benefit from the research.

6.4.6 Distribution Networks

Delivery of actions identified in this SEAP report will require complementing changes and upgrades to existing GM energy infrastructure. In particular, upgrades to infrastructure may be required to:

1). Ensure that the grid can cope with additional electricity demand to charge electric cars (and potentially further increases in use of digital technology and electric heating and cooling);

2). Enable development of distribution networks that can manage a very large number of supply sources and a potentially intermittent supply to support decentralised energy generation; and

3). Development of Heat Network. This is further discussed in Section 7.

The implementation of Smart Grids could enable the delivery of the first two objectives. There are a wealth of benefits associated with Smart Grids, for example they can enable pricing of electricity depending on demand, the collection of data to inform patterns of generation, work with smart meters to encourage behavioural change and enable more flexible management of supply systems.

The latter is important because electricity is likely to come from a large number of different sources in the future and there are risks that the supply may become intermittent because of the types of generators and the price of fossil fuels and energy. Smart Grids can help manage this to ensure that GM has a secure, reliable source of energy to support businesses and residents.

Smart Grids can enhance the local electricity distribution network using information and communications technologies, to enable the connection of renewable macro, community and micro distributed energy generation technologies, and provide consumer information to support behavioural change.

Enabling Action

Support research and development of Smart Grids in GM, including putting forward GM as a centre of learning and development in the field of Smart Grids.

The following steps should assist in the implementation of this action:

1). Bring together existing and emerging research on Smart Grids in GM building on the strong relationships already in place between Manchester University, Salford University, the Joule Centre and other partners, and the business understanding of distribution issues across GM.

2). Establish a working group of actors involved in Smart Grids and smart technologies to develop a coherent approach to Smart Grid development and deployment for GM in the context of its wider approach to energy and smart technologies;

3). Support development of Smart Grid pilots in GM and develop a work programme for implementation; and

4). Continue engagement with Electricity North West on benefits of Smart Grids and potential additional locations.


BRADFORD
BLACKBURN
Horwich
Bury
BOLTON
Middleton
OLDHAM
Saddleworth
MANCHESTER
Hindley
Swinton
Ashton
Eccles
SALFORD
Stalybridge
2060
Stocksbridge
Glossop
Kinder Scout
2088
Snake Inn
Hyde
STOCKPORT
Hazel Grove
Hayfield
New Mills
SHEFFIE
WARRINGTON
Altrincham
Sale
Cheadle
Poynton
Whaley Bridge
Castleton
Buxton
Macclesfield
Wilmslow
A580
M62
M63
M60
A57
A6
A625
A623
A34
A538

Section 7
Supply: Macro and Community Scale Renewable and Low Carbon Energy Actions

7.1 Introduction

These actions comprise methods and technologies which can work towards decarbonisation of energy through the generation of low or zero carbon electricity and/or heat. This section covers 'macro' and 'community' scale technologies, defined as all technologies that cannot be integrated into a building.

7.2 Potential National Actions

Delivery of renewable and low carbon generation at a national level will provide an associated benefit via the decarbonisation of grid supplied electricity. Mechanisms that can support grid decarbonisation (e.g. Renewables Obligation[37]) are considered in the development of both grid decarbonisation scenarios.

7.2.1 Grid Decarbonisation

Market Transformation Programme (MTP) Projections

DEFRA's Market Transformation Programme (MTP), which supports and informs decisions on UK Government energy policy, has produced projections of how the grid is predicted to decarbonise up to 2020. These figures have been used to quantify the extent to which decarbonisation of the grid would result in lower CO_2 emissions in GM. This trend has been projected to 2050 to provide an estimate for CO_2 emission savings between 2020 and 2050[38].

Grid decarbonisation, as predicted by the MTP projections, would result in a reduction of overall GM CO_2 emissions by 8.9% by 2020 and 30.7% by 2050.

Low Carbon Transition Plan

The Low Carbon Transition Plan (LCTP) has set a target for 40% of the UK's electricity generation to be derived from renewable sources by 2020. This represents a notable increase when compared to the proportion of renewable generation assumed by the MTP projection of 16%.

As such, a second scenario has been modelled for grid decarbonisation in line with the LCTP target for 2020, with additional renewable generation partially displacing the proportion of coal and gas fuelling assumed in the MTP. Once again, the trend of renewable adoption and resulting grid electricity emissions factor has been projected up to 2050 to provide an indication of potential overall savings for GM.

GM emissions savings resulting from meeting LCTP targets would reduce GM CO_2 emissions by 22.9% by 2020 and 39.8% by 2050.

7.2.2 Feed-in Tariffs (FiTs)

The UK Government introduced Feed-in Tariffs (FiTs) in April 2010 to incentivise the decentralised generation of renewable electricity. FiTs provide guaranteed income streams for the generation and export of renewable electricity, with bespoke tariffs for a range of technologies in recognition of the varying capital and operating costs. These tariffs are offered for small-medium scale technologies with generating capacities of up to 5MWe. Therefore, they can be used for community scale electricity generation schemes and a large proportion of micro renewable electricity generation technologies. The Coalition Agreement issued on 12th May 2010 states that the Government intends to maintain feed-in tariff systems. This would be an 'enabling action' and has no associated direct CO_2 reduction.

It should be noted that FiTs and the Renewable Heat Incentive (RHI) below are designed to stimulate the market and increase the viability of technologies in the short-term. These incentives will not be available indefinitely and residents may wish to act quickly to capture the benefits. To a certain extent, it could be argued that micro-generation technologies may become less viable when these incentives are no longer available. However, it could equally be argued that the incentives will stimulate the market, encouraging innovation and the improvement of technologies so that technologies will be viable without incentives in the future.

[37] *The Renewables Obligation is an obligation on licensed electricity suppliers to source an ever increasing proportion of electricity from a renewable source. The Renewables Obligations Order 2006 is the Government's main policy measure to encourage the development of electricity generating capacity using renewable sources of energy in the UK and is intended to remain in place until March 2027.*

[38] *It should be noted that, in reality, the extent to which electricity used from the National Grid is 'decarbonised' will depend on the season and the time of the day. For example, in the future the Grid may be lower carbon when the wind is blowing, or when demand is low (and gas-fired power stations and not running). Installation of Smart Grids could potentially help manage this in the future, and couple potentially include systems for pricing energy so that it is more expensive when it is more carbon intensive.*

Further, there could be a wealth of different mechanisms to encourage micro-generation developed in the future that could replace these incentives if required. Therefore, this SEAP report assumes that these incentives can increase the short-term viability of technologies, with no assumption made about whether technologies will become less viable once the incentives are no longer available.

7.2.3 Renewable Heat Incentive (RHI)

The Renewable Heat Incentive (RHI) is a scheme proposed to incentivise the generation of heat from renewable sources such as solar thermal technologies. The scheme is currently under consultation for proposed introduction in April 2011. This would be an 'enabling action' and has no associated direct CO_2 reduction.

7.3 Potential GM Actions

7.3.1 Introduction

The following section provides a projection of the potential CO_2 savings that could result from implementation of macro and community scale renewable and low carbon energy supply technologies in GM. The incentives offered by FiTs for the uptake of small-medium scale renewable electricity generation has been considered when estimating the realistic uptake of technologies.

7.3.2 Energy from Biomass

The generation of heat and electricity from biomass is ultimately limited by the ability of GM to source fuel supplies. The resources considered here include:

- Waste Wood;
- Managed Woodland;
- Arboriculture; and
- Energy Crops.

In combination with resource potential, any implementation of biomass technologies must also be driven by existing and future demands for related heat generation, so that any heat generated is not 'wasted'. In order to minimise costs of heat delivery, technologies must be based as locally as possible.

The savings below assume that the biomass is used in biomass Combined Heat and Power plants as this would currently result in the largest CO_2 emissions saving. However, biomass could also be used to generate heat alone if this was a more viable, desirable or efficient option. Estimates have been adapted from Arup (2008). Support would be required to develop heat networks to capture the heat.

Potential GM emissions savings from biomass Combined Heat and Power plants have been projected as 0.3% by 2020 and 1.2% by 2050.

7.3.3 Energy from Waste

Results from Arup (2008) were used to estimate potential CO_2 reductions from the following potential waste streams:

- Landfill Gas;
- Municipal Waste;
- Sewage Sludge; and
- Sewage Gas.

Again, the numbers below assume that Energy from Waste is used to generate heat and electricity, but it could be used to generate heat alone if this were preferred. Support would be required to develop heat networks to capture the heat.

Potential GM emissions savings from Energy from Waste have been projected as 0.5% by 2020 and 2.2% by 2050.

7.3.4 Wind

The DES assessed and quantified the amount of potential GM land suitable for onshore wind turbines. Figures for combined turbine capacity and electricity output were also derived based on the following land classifications:

- Less constrained land; and
- Variably constrained land.

These generation figures have been used to assess the related emissions savings deliverable in GM.

Based upon initial utilisation of the identified 'less constrained land', potential GM emissions savings from wind have been projected as 0.4% by 2020. Additional utilisation of the 'variably constrained land' was used to predict emissions savings of 1.3% by 2050.

7.3.5 Hydro-Electricity

Whilst the Arup (2008) study returned a figure for potential NW hydro-electrical generation, this was a small figure and it is projected that only a small proportion of this potential exists within GM.

It is projected that hydro-electricity could provide up to a 0.02% saving in overall GM emissions by 2020 and up to 0.04% by 2050.

7.3.6 Minewater Geothermal

The extent to which existing minewater could be used to extract energy from disused colliery sites within GM has been quantified by M:KC in the baseline work for this study.

A realistic uptake of minewater geothermal technologies could provide up to a 0.1% saving in overall GM emissions by 2020 and up to 0.7% by 2050.

7.3.7 Heat Networks

The DES identified a number of specific opportunities for the creation of district heating networks within GM. Where possible, the potential CO_2 emissions savings achievable via these networks have been quantified.

Manchester Town Hall Cluster

The feasibility of a district heating network centred around Manchester Town Hall is currently being considered. Generation options currently suggest use of a Combined Heat and Power plant in the order of 10MWe, to be either gas or biomass-fuelled. To avoid double-counting, for all larger graphs we have assumed that the plant would be fuelled by gas rather than biomass, although the latter would result in additional CO_2 savings.

Based on the staged growth of such a network, it has been estimated that a 0.1% saving in overall GM emissions could be delivered by 2020, assuming use of a natural gas-fired plant. Savings achievable by 2050 would remain at a similar level as in 2020 for a gas-fired CHP arrangement although emission reduction via biomass fuelling could reach 0.3% by 2050.

Manchester City Centre

The DES study describes the potential for the organic growth of a district heating network around Manchester City Centre, with the Town Hall Cluster representing an initial step toward this development. Additional CHP plant capacity to serve the network has been suggested in the region of 30 MWe.

Based on the staged growth of such a network, it has been estimated that a 0.2% saving in overall GM emissions could be delivered by 2020, assuming use of a natural gas-fired plant, or up to 0.5% if CHP were biomass-fuelled. Savings achievable by 2050 are predicted to increase to 0.3% in 2050 for a gas-fired CHP arrangement and could reach 0.8% by 2050 via biomass fuelling.

Sub-Regional Networks

The DES also identified the potential for 8 additional networks, positioned in sub-regional centres and supplied by CHP plants with capacities in the order of 5 – 10 MWe.

Based on the staged growth of such networks, a GM emissions saving of 0.2% has been projected for 2020, assuming natural gas-fired plant, or up to 0.7% if CHP were biomass-fuelled. Savings achievable by 2050 could rise to 0.4% using gas or 1.3% using biomass fuelling.

Local Heat Networks

Also identified was the potential for up to 34 smaller local networks, centred around existing public buildings and supplied by CHP plant with capacity in the order of 1 – 5 MWe.

Based on a similar staged growth of such networks, a GM emissions saving of 0.2% has been projected for 2020, assuming natural gas-fired plant, or up to 0.7% if CHP were biomass-fuelled. Savings achievable by 2050 could rise to 0.5% via further development of gas-fired CHP arrangements or 1.4% via biomass fuelling.

7.3.8 Summary

The graph in Figure 16 shows what all the potential actions would achieve if they were implemented.

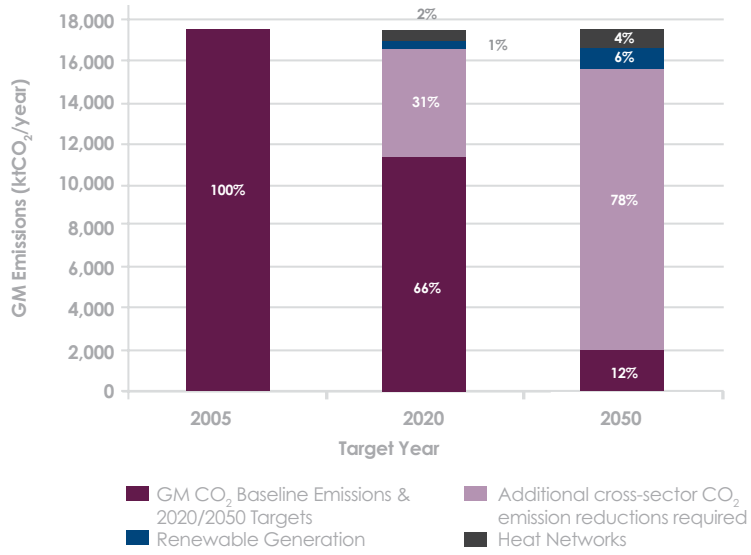


Figure 16: Comparison of CO_2 Reductions from Potential Macro and Community Scale Generation Actions and SEAP report Targets of 34% by 2020 and 88% by 2050

7.4 What is Happening Already in GM?

LAs and key stakeholders in GM are very aware of the need to consider renewable and low carbon energy generation to meet carbon reduction targets and deliver a secure energy supply. Recent actions in GM have included:

- **Scout Moor wind farm** (approximately 65MWe capacity);
- Identification of five feasible sites for **hydroelectric power** generation schemes in Stockport, three of which could be brought forward fairly rapidly;
- Research work on potential for **energy from waste plants** in GM;
- Feasibility work for development of a **district heat network around Manchester Town Hall;**
- **Co-operative Group** plans to develop an integrated energy system to meet 100% of Northern Gateway's future heat and power needs;
- Phase 1 of the **Carrington Power Station** was granted full planning permission in July 2008, with construction due to start summer 2011. The second phase was granted planning permission in April 2010 with plant design to be finalised in 2012. Discussions are continuing to investigate the potential to utilise waste heat from the power station in a district heat network running along the Ship Canal growth corridor.
- Discussions have been held around other district heat networks identified in the DES, for example, schemes at Bolton (heat from Raikes Lane EfW), Bury **(heat from Pilsworth landfill gas) and Oldham (heat from biogas PFI plant).**
- The following LAs have set targets for low carbon and renewable generation from **new developments** in adopted or draft Local Development Framework documents:
- **Bolton:** Larger developments[39] to incorporate decentralised, renewable or low carbon energy sources to reduce CO_2 emissions by at least 10%.

[39] *5 or more residential units or 500m² or greater non-residential units*

- **Manchester:** Sets out a target framework for CO_2 reductions from energy supply for new development, dependent on what type of area the development is in. Three categories of areas are defined as 'heat network areas', 'electricity intense areas' and 'micro generation areas'.
- **Salford:** Aims to achieve a direct CO_2 emission rate of at least 15% below Part L1A of the Building Regulations 2000, which could include renewable/ low carbon energy generation.
- **Stockport:** Target percentage is set for new developments beyond the 2006 Target Emissions Rate which could include measures to support renewable/ low carbon energy generation.
- **Trafford:** Larger new developments[40] to reduce carbon emissions, which could include renewable/ low carbon energy generation.

Whilst progress is being made across many LA areas, there is a recognised need for co-ordination and sharing of expertise and information, to bring projects forward.

7.5 Recommendations for Priority Actions

Planning applications for very large renewable and low carbon energy generation schemes will be decided by central Government through the Secretary of State, the Infrastructure Planning Commission or an alternative body created by the new Government. Therefore, the role for GM may be more focused around liaising with national Government to bring these schemes forward, than directly facilitating schemes. For example, GM could lobby Government for a more consistent and transparent approach to planning applications for large-scale wind energy developments.

This SEAP prioritises those actions that GM has most influence over and can most effectively reduce carbon emissions. This suggests that macro and community energy supply actions should initially be prioritised around the delivery of district heat networks, solar power, community energy schemes and facilitating wind energy.

7.5.1 District Heat Networks

District heat networks in GM could utilise a variety of sources including Carrington Combined Cycle Gas Turbine (CCGT) power station, EfW, biomass, and biogas.

Primary Action

Support the development of district heat networks in GM where they are viable and would reduce GM's CO_2 emissions.

The following sections outline the steps that could be taken to implement this action.

7.5.1.1 Consistency in Information to Support Heat Networks

The DES carried out work at the GM level including large-scale mapping of heat demand, heat supply and existing district heating infrastructure. Further, more detailed work has been carried out by some LAs to inform the development of particular district heating projects and/ or provide evidence to support planning policies. However, not all LAs have carried out this more detailed work, and studies are not necessarily being carried out using a consistent approach across GM. In some cases the lack of detailed mapping could delay or discourage the development of district heat networks because of the need to generate baseline data for each individual network.

The lack of consistent data also makes it difficult to co-ordinate actions across LA boundaries and can mean that all LAs are investing resources in developing their own methodologies, with a potential cost saving achieved through agreement on a common method.

The central station in Stockholm is Scandanavia's busiest travel hub. The body heat generated by 250,000 daily travellers is used to heat a nearby office building using a local heat network.

[40] *Above 10 residential units or 1,000m²*

ENABLING ACTION

Develop a consistent GM heat map

The steps to deliver this action include:

1) Develop a spreadsheet that sets out the information LAs could require to develop detailed heat maps for their areas;
2) Develop an online heat map for GM using sub-regional and LA data that shows:
    a) Heat demand;
    b) Potential heat suppliers; and
    c) Existing heat networks.
3) Identify key information gaps and engage in discussions with LAs about how to fill these gaps;
4) Prioritise gaining more detailed baseline information in areas where key projects have been suggested. In particular, work with stakeholders and existing consultants to identify potential heat customers for Carrington Power Station to aid feasibility work. The timescales for plant design suggest that this should be a short-term priority.

Enabling Action

Define the parameters of what constitutes an 'opportunity' for a heat network.

A second priority action could be for each LA **to define the parameters of what constitutes an 'opportunity' for a heat network** in its area. Parameters could depend on the availability of heat demand and supplies, but also local issues such as land ownership, political aspirations and costs. These parameters can then be used by the LA alongside the heat map to identify district heat projects in their area in the future. A clear set of parameters will enable LAs to discuss with developers where opportunities could be brought forward alongside new developments, to identify and/or prioritise opportunities for heat networks in their area in the future, following on from DES work to date.

LAs could also develop a technical standard for a heat network (i.e. operating temperature, pressure and size of pipes), so that disparate heat networks could be easily combined at some point in the future.

7.5.1.2 Information Sharing and Changing Perceptions of Heat Networks

Amongst some stakeholders, there is also a lack of knowledge and understanding of heat networks and their implementation.

Enabling Action

Encourage information sharing on heat networks throughout GM.

Steps to implement information sharing could include:

1) Publicising and encouraging sharing of information gained through developing the Manchester Corridor heat network; and
2) Developing a set of GM case studies on heat networks. Case studies could encourage positive perceptions of heat networks and facilitate knowledge sharing.

7.5.1.3 Manchester Corridor Heat Network

The Manchester Corridor, with its abundant, reliable sources of heat demand, knowledge centres and centrality to the GM economy could be a priority project for the delivery of heat networks. As feasibility work is currently underway, it is suggested that the main action at this stage will be to monitor the outcome of the feasibility study and use this to inform the development of future actions to facilitate its delivery.

Enabling Action

Share experience gained through development of a Manchester Corridor heat network across GM.

7.5.1.4 Carrington Power Station as a Heat Supplier

Carrington Power Station could potentially provide a large amount of heat that could be used in the local area. However, there is a need to identify heat customers who are able and willing to sign long-term contracts for heat to make it a viable option. There is also a need to identify additional heat suppliers to provide heat when Carrington is unable to meet heat demands. It should be noted that, as with all technologies, the price of fuels will affect the operation of the Carrington Power Station.

For example, if gas prices rise significantly during a cold period the power station could become unviable for a short time and stop generating heat and electricity.

This is another reason why it is important to ensure that district heat networks use heat supplies from a number of sources that can be 'switched on' when Carrington Power Station does not generate sufficient heat to meet demand.

Primary Action

Support development of a heat network utilising waste heat from Carrington Power Station.

The following steps are suggested to facilitate the development of a heat network from the Carrington Power Station:

1) Identify potential heat customers who can sign long-term contracts for the heat supply to increase the viability of a network;
2) Assist in work to examine the feasibility of the heat network to serve these customers (i.e. are customers located close enough so that length of pipe routes will be economically viable); and
3) Identify additional sources of heat that could be connected to the future heat network, potentially including discussions over future planning decisions to locate future heat demands and/ or supplies around the network.

As part of implementation step three, the potential for biomass as a heat supply should be considered. However, in doing so, care should be taken to ensure that there are available supplies, in relatively close proximity to GM and that these supplies do not raise issues associated with food security.

7.5.2 Energy from Waste Plants as Electricity and Heat Suppliers

The potential contribution of Energy from Waste (EfW) plants to decarbonising the energy supply in GM is the most significant of all technologies examined.

When establishing the potential for EfW plants, it will be important to ensure that there is an available supply of waste suitable for energy generation in or near GM. There is a substantial amount of waste in the Commercial, Services and Industrial sectors that is not utilised through GM Waste PFI. The latter covers the residential sector and has established contracts for 25 years. It has been estimated that there is 350,000 tpa of waste potentially available for EfW in GM from commercial/services and industrial sectors.

Therefore merchant EfW plants could be a good source of heat and power for GM. This would need to be investigate further to ensure a ready supply of EfW will be available for plants.

Primary Action

Support development of Energy from Waste plants to generate electricity and heat.

This action could be supported by:

1) Identify priority EfW projects in GM using emerging research on EfW and information about potential EfW suppliers in the GM heat map;
2) Engage with waste professionals to agree a strategy for bringing forward EfW plants, including utilising information on potential heat customers and existing heat infrastructure as well as consideration of connections to the distribution network for the electricity generated;
3) Ensure that when EfW plants are specified, they need to consider whether the development of heat networks is appropriate; and
4) Consider whether an electricity and heat plant is the best option, or whether it would be better to deliver a heat-only plant.

7.5.3 Delivery of Large and District Scale Wind Schemes in GM

There is an identified wind resource in GM that can be utilised for large and district scale wind turbines. The main barrier to the development of wind schemes is a political one, namely the ability of schemes to gain planning permission.

Primary Action

Facilitate the development of macro-scale wind turbines where appropriate.

As the main barriers are political, the steps to implement schemes are covered in the 'cross-cutting enabling actions' section of this report, namely those related to developing a supportive political and planning context for wind turbines and discussing a way forward with national government.

7.5.4 Community Scale Renewable Energy Schemes

There is the potential to deliver CO_2 emission reductions using community scale (and larger scale) renewable and low carbon technologies. Community scale schemes are likely to be specific to the area they are located within and therefore, no one technology is recommended here. However, the potential for these technologies should be investigated, implemented and experience shared across GM.

Primary Action

Facilitate the development of macro-scale wind turbines where appropriate.

The following steps are suggested to deliver community scale renewable energy schemes.

1) Consider a wider GM study on the feasibility of community level schemes building on previous work (e.g. DES). For example, this could include a wider study of the potential for hydropower and biomass schemes.
2) Use future central GM structure and resources to support future schemes if feasible and necessary;
3) Encourage LAs to share information on the development of community level renewable energy schemes with GM to facilitate schemes in other areas; and
4) Implement and support schemes in a way that maximises economic benefits for GM by considering sourcing labour and technologies from within GM where possible.

7.5.5 New and Emerging Renewable and Low Carbon Technologies

New and improved renewable and low carbon technologies are being developed all the time and GM will need to keep up to date with technological changes to support the development of a low carbon economy and maximise economic benefits to the area and CO_2 emission reductions.

Enabling Action

Engage with Universities and private sector businesses in GM to explore and remain up to date with opportunities for new and innovative renewable and low carbon energy technologies.

This could involve working with Universities to capture new research in SEAP report annual updates, looking at new and emerging technologies such as capturing energy from transport.

Section 8
Supply: Micro-Generation Actions

8.1 Introduction

Actions to promote micro-generation have been set out below. For the purpose of this report, micro-generation technologies have been defined as those that are integrated into buildings. It should be noted that the sustainable energy action planning process does not quantify the potential impact of all micro-generation technologies on CO_2 emissions, but instead concentrates on those technologies that are considered to be more viable and/ or have potential for largest emission reductions in 2010. The priority actions also include some recommendations for further information gathering to support implementation of other technologies and it is likely that more micro-generation technologies will be considered in future iterations of the SEAP report.

8.2 Potential National Actions

The main national actions on micro-generation are the introduction of FiTs and the proposed RHI discussed in the previous section. However, these incentives will need to be supported and publicised at the GM level to maximise their impact, this action is described in the recommendations in Section 8.5.

8.3 Potential GM Actions

8.3.1 Micro-Combined Heat and Power

Whist still in its infancy as a proven technology at smaller scales, the incorporation of micro-CHP into residential buildings where suitable opportunities exist would allow for the local generation of both heat and electricity. Related emission savings are derived through the displacement of grid-imported electricity and associated inherent electrical transmission losses.

Based upon a limited update of micro-CHP (where appropriate), initial GM emissions savings of 0.6% are predicted by 2020, rising to 1.3% by 2050.

8.3.1 Photovoltaics

Now a well-established technology with ever-increasing efficiency, photovoltaics (PV) present a method by which renewable, zero carbon electricity can be generated to offset grid importation. Feed in Tariffs are leading to vastly improved payback periods for PV and are expected to produce a related increase in uptake of the technology.

Potential GM emissions savings are up to 1.1% are predicted by 2020, and 2.1% by 2050. The majority of these technologies are assumed to be installed on residential buildings.

8.3.3 Solar Thermal

Solar thermal panels provide a method for the generation of zero carbon heat to (partially) displace the burning of gas or other fossil fuels. The RHI is likely to increase the commercial viability of the technology.

Overall GM emissions saving from solar thermal installations of up to 0.6% are predicted by 2020, and 1.3% by 2050.

8.3.4 Heat Pumps

Heat pumps could have a role to play in reducing CO_2 emissions. The benefit of heat pumps is clearly shown by their Coefficient of Performance (CoP) range. For example, 1kWh of electrical energy can produce up to 2.5 to 4kWh of heat or coolth dependant on the type of heat exchange loop (i.e. ground, water or air). Heat pumps partially displace traditional gas/fossil fuel burning or electricity use, but rarely negate the need for top-up energy use from these sources. Given the current CO_2 intensity of National Grid electricity, most heat pumps currently provide a negligible overall benefit, particularly at lower CoP's. However as the National Grid decarbonises the benefits of heat pumps will improve significantly and the technology should be considered in the future.

8.3.5 Additional Low Carbon/Renewable Technologies

Technologies such as smaller biomass boilers and micro-wind have not been considered here but should be considered in future SEAP report iterations as new technologies emerge and/ or become more viable.

8.3.6 Summary

The graph in Figure 17 shows what all the potential actions (including the essential priority actions) would achieve if they were implemented.

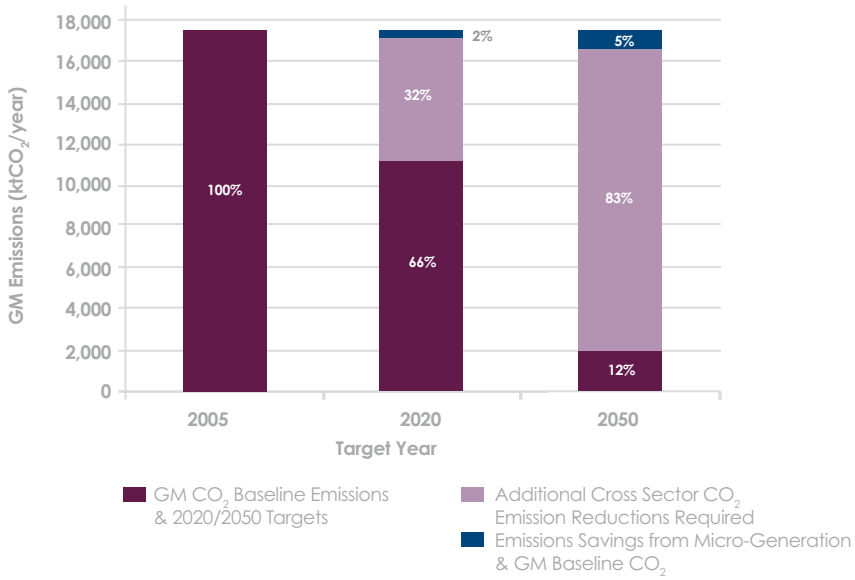


Figure 17: Comparison between CO_2 Reductions from Potential Micro-generation Actions and SEAP report Targets of 34% by 2020 and 88% by 2050

8.4 What is Happening Already in GM?

The LCEA programme includes actions to encourage the uptake of micro-generation technologies on residential properties and could include development of supply chains and the upskilling of installers. Therefore, some of the actions below around supply chains may be best led by the LCEA. Some LAs (e.g. Manchester) have identified areas suitable for micro-generation and are encouraging inclusion of micro-generation on developments in these areas. This could help integrate micro-generation technologies into new developments.

Envirolink Northwest compiles lists of businesses that can supply and assist with installation of technologies to reduce CO_2 emissions, including businesses that can supply micro-generation technologies. However, an average business or resident considering installation of micro-generation may not know of this resource.

8.5 Recommendations for Priority Actions

As microgeneration technologies are integrated into buildings, many of the delivery mechanisms will be dictated more by the type of building than the type of micro-generation technology. Therefore, although the actions are discussed here as supply actions, it is likely that they would be implemented as part of comprehensive residential, commercial and industrial interventions described in the demand sections.

8.5.1 Finance and Funding for Micro-Generation

It is suggested that because national funding is available for microgeneration, it is likely that technologies will become more affordable over time and the focus of action may be more around promoting FiTs, RHI and the ease of implementation rather than seeking additional sources of funding.

Enabling Action

Promote funding and finance benefits of micro-generation.

This action can be carried out through:

1) Promotion of FiTs and the RHI when rolling out commercial and residential retrofitting actions;
2) Provision of clear information about the financial costs and benefits of microgeneration schemes and direct people to further information; and
3) Consider conducting research on the impact of microgeneration on house re-sale prices. This will provide GM with a clear view of the nature of the issue (i.e. perceptions or genuine lack of impact on house values).

8.5.2 Development of Local Supply Chains

A main barrier to the delivery of micro-generation technologies is the lack of knowledge of local supply chains that can deliver technologies at affordable prices. For some technologies there are local supply chains but these are not well known, for others there are no readily available, affordable technologies. If products are manufactured in GM this could stimulate economic growth and reduce CO_2 emissions generated in the transport of technologies. However, even if some micro generation systems are manufactured abroad, there are still significant job opportunities associated with the installation and maintenance of technologies.

Enabling Action

Encourage development of local supply chains for microgeneration technologies.

The following steps are recommended to implement this action:

1) Engagement with Envirolink Northwest and Enworks to discuss promotion of their publicly available lists of businesses who can supply and install micro-generation technologies;
2) Consider development of a resource that people can use to help them find a supplier and installer of micro-generation technologies. A potential resource could allow customers to rate companies for their installation and products for ease of use, money saved etc. This could help to reassure people about these 'new' technologies and encourage businesses to provide a good service.
3) Identify gaps in current supply chains and determine a way to address the short fall.

8.5.3 Area Based Roll out of Micro-Generation Technologies

At present there may not be a sufficient demand to support local supply chains for micro-generation. Further, many consumers lack confidence in the technologies and think of them as new and uncertain. Therefore, a priority action should be to identify a selection of areas for area based roll out of micro-generation to help provide economies of scale and promote the viability of technologies.

Primary Action

Develop and implement area based microgeneration schemes in three areas of GM.

These actions could be implemented using the following steps:

1) Use existing work developed through the DES and subsequent LA studies to identify three areas that might be suitable for micro-generation technologies. This would likely be implemented in partnership with the LCEA.
2) Review the types of technologies that could be used in that area and identify suppliers who could meet the demand;
3) Develop a communication strategy for the micro-generation areas promoting the benefits of micro-generation and potentially offering advice on whether a person's home or office would be suitable for micro-generation; and
4) Develop partnership mechanisms for delivering the schemes, potentially using a form of public-private partnership. A preferred supplied could be identified who would provide a service including advice to potential customers on suitable technologies, installation of technologies and provision of advice on maintenance.

If possible, the three areas would include different types of buildings to include at least one predominantly residential area and one predominantly commercial area.

Section 9
Transport Actions

9.1 Introduction

This section provides a summary of existing and potential actions to reduce CO_2 emissions from transport. It should be noted that this report has not yet been able to incorporate a great deal of research on the potential CO_2 reductions from transport in GM and consequently, there is less certainty over CO_2 emission reductions from transport than those that can be achieved by, for example, district heating. Therefore, projections should provide a starting point to examine transport interventions to be revisited in future SEAP report iterations. There is a great deal of action and research being undertaken in this arena and capturing this knowledge to inform the sustainable energy action planning process will be a priority going forwards.

9.2 Potential National Actions

9.2.1 Aviation and Shipping

Air travel has doubled since 1990, with further increases projected for the next 20 years (HM Government, 2009). There has also historically been a lack of consensus on how to allocate aviation emissions to a particular country, however, efforts are being made to allocate emissions to countries and reduce these emissions[41]. Therefore, the Committee on Climate Change (2009) concluded that it was possible to maintain aviation emissions at 2005 levels with potential investments in alternative fuels for aircrafts, increased efficiency and management of demand. In other words, with national and international incentives, the change in aviation emissions between 2005 and 2050 would be 0%[42].

As with aviation, there has been a lack of agreement on how to allocate shipping emissions. Estimates suggest that even with measures to constrain emissions, global shipping emissions in 2050 could be twice current levels (Committee on Climate Change, 2009). Again, projected changes to international shipping, with intervention, have been used to shape the SEAP report target, so further actions are not discussed here.

If emissions from aviation and shipping stay at 2005 levels, emissions from other sources would need to reduce by a larger amount to compensate. This has been taken into account in development of the SEAP report targets.

International and national interventions on aviation are expected to provide a reduction in overall GM CO_2 emissions savings of 0% by 2050. International shipping is projected to increase by 2050. These savings have been considered in development of the SEAP report target, with targets focusing on what would need to be achieved from non-aviation and shipping emissions.

9.2.2 Driver Efficiency for Freight and Buses

The fuel efficiency of a vehicle is partially dependent on the way the vehicle is driven. The driver Certificate of Professional Competence is a scheme for drivers of large goods vehicles and passenger carrying vehicles who driver professionally throughout the UK. It has been developed as a requirement of the EU Directive 2003/59, which is designed to improve the knowledge and skills of professional drivers. The initial qualification must be achieved by new drivers and all professional drivers must attend 35 hours of training every 5 years.

Increasing freight and bus driver efficiency could provide a reduction in overall GM CO_2 emissions of 0.7% by 2020 and 0.9% by 2050.

9.2.3 Freight Mode Capacity Increase

One way to reduce CO_2 emissions would be to increase the amount of freight that a particular mode of transport can carry in one trip. When designed correctly, this could result in a lower amount of CO_2 emissions per kg of freight carried. The UK has one of the lowest load regulation levels in Europe, meaning that to increase the mode capacity of freight vehicles by a significant amount would require changes in the UK regulations, which may be unlikely under the new Government. Therefore, this action has been classified as a national action and one that may be more effectively changed at the national level.

[41] *For example, from 2012, all flights arriving and departing from European airports, domestic and international, will be part of the European Union Emissions Trading Scheme.*

[42] *It is unlikely that emissions from aviation will remain at 0% compared to a 2005 baseline between 2005 and 2050, however, this report was unable to source data within the timeframe to base an assumption on about aviation emissions during this period.*

Should regulations change, however, there may be a role for GM in supporting and encouraging businesses to take advantage of changing regulations and increasing the capacity of their freight vehicles.

The projections below are based on the assumption that this intervention could reduce emissions from freight vehicles by 10%, but that the uptake would be a modest 20% in the short-term on account of the need for regulatory change, with a 60% take up by 2050.

Freight mode capacity increases could provide a reduction in overall GM CO_2 emissions of 0.1% by 2020 and 0.6% by 2050.

9.3 Potential GM Actions

9.3.1 Aviation and Shipping

GM contains the Manchester Airport, a very significant contributor to the economy. As described above, emissions from aviation and shipping have been subtracted from the SEAP report target. In the future there may be cause to revisit this assumption if Manchester Airport feels that it has sufficient ability to support and influence the emissions from aviation in the future. Emissions from ground activities at the airport are covered in the commercial and transport sections.

GM does not have a coast so the impact that GM could have on international shipping would be minimal[43] and it is unlikely that there would be merit in discussing shipping in more detail in the future.

9.3.2 Making Smarter Choices: Modal Choice

Modal choice concerns the way in which transport users decide which mode of transport to use to make a particular journey. This choice will be affected by factors such as cost, convenience, travel time and habit. Changing the modes of transport that people and businesses decide to use is one of the actions with potentially the largest CO_2 reductions but can be the hardest to achieve. The largest CO_2 savings can be achieved by moving travel choices away from the most CO_2 intensive form of travel (personal car), towards public transport and very low carbon modes like walking and cycling.

Given the wide range of activities that can induce people to change their travel behaviour, and the range of CO_2 savings that could result from these actions, it is very difficult to provide estimates of CO_2 reductions with any degree of accuracy. For example, if a person who formerly drove to work chose to cycle to work the CO_2 savings would be much greater than if they now took the train. Similarly, the reductions possible from a car sharing scheme would depend on how many people share a car, and how far people need to drive to pick up people they car share with. It is highly likely that future research into transport actions in GM will be able to provide more accurate estimates of potential CO_2 reductions from interventions that promote more sustainable travel choices. However, the below provides a ball park figure to facilitate discussions.

The potential CO_2 reductions below assume that it would be possible to cut emissions from personal cars by 33% using a variety of different actions, but that in reality only 10% of this would be achievable by 2020, and 50% by 2050. The small take-up in the short-term could be increased if GM were able to introduce infrastructure to support sustainable modes of transport and behavioural change programmes relatively quickly over the next few years.

Modal choice towards more sustainable modes of transport could reduce CO_2 emissions in GM by 0.5% by 2020 and 2.4% by 2050.

9.3.3 Driver Efficiency for Personal Transport

There are potential CO_2 savings associated with increasing the efficiency of car drivers in GM. Changing the driver behaviour of individual car drivers would be much more difficult than changing the behaviour of professional drivers because there is no regular mandatory training after a person has passed their driving test. However, as cars account for over half the transport emissions in GM, even a modest uptake of training schemes could have a significant impact on CO_2 emissions.

As above, the calculations assume that it is possible to reduce emissions from cars by 10% through energy efficient driving, but that the take-up would be modest (20%) in the short-term because of the difficulties associated with changing individuals' driving behaviour.

[43] *The only impact GM could have is through indirect actions such as purchasing products manufactured overseas. As embodied energy is outside the scope of this 2010 SEAP, this impact is not considered here.*

Encouraging car drivers to drive more efficiently could result in 0.3% reduction in CO_2 emissions by 2020 and a 0.5% reduction by 2050.

9.3.4 Maintenance of Existing Vehicles

Maintaining a fleet of freight vehicles in good working condition ensures optimal fuel efficiency and mitigates against an increase in CO_2 emissions from poorly maintained engines. Similarly, educating the general public about the benefits of good car maintenance can lead to wider fuel efficiency benefits and consequently CO_2 savings. For example, ensuring that car tyres are inflated to the optimum level can produce better fuel efficiency. Similarly, replacement of engines in existing vehicles with more fuel efficient engines can reduce CO_2 emissions.

The projections below assume that CO_2 emissions from transport can be reduced by a maximum of 6% through good maintenance and that a take-up level of 20% could be achieved, again with limitations due to the lack of powers to regulate a person's driving habit, with potentially larger changes possible for freight.

Maintenance of existing vehicles could potentially reduce GM CO_2 emissions by 0.3% by 2020 and 1% by 2050.

9.3.5 Public Transport Mode Capacity Increase

Increasing the capacity of a transport mode will allow more people to travel in the same amount of space, resulting in less carbon emissions per person being produced from the same vehicle and may reduce the number of vehicles required to carry the same number of persons. For example, one way to increase mode capacity could be to reduce the number of seats on public transport modes in favour of standing spaces or reduce the first class provisions on vehicles at certain times. Additionally, public transport capacity can be increased by providing more frequent services, which may make them more attractive to passengers and reduce car use.

The success of schemes in reducing CO_2 emissions will depend on how mode capacity is increased and the degree of behavioural change that accompanies interventions. Of course, adding an additional carriage on a tram will not reduce CO_2 emissions unless more people choose to use the tram.

Conversely, measures to reduce the number of seats on trams could have a negative impact on CO_2 emissions if it means that people view public transport as less attractive because they need to stand. Increased frequency of services may be one of the most effective measures if this contributes towards behavioural change.

Given that CO_2 emission reductions from behavioural change have been assessed above, the additional reductions from increased modal capacity are smaller than might be expected, highlighting the importance of considering interventions together. Consequently, it is estimated that increasing capacity of buses, trams and trains in GM could reduce transport emissions by 3%.

Increasing the capacity of public transport could reduce GM CO_2 emissions by 0.1% by 2020 and 0.4% by 2050. These figures could be larger if implemented alongside measures to encourage behavioural change.

9.3.6 Reducing Distance Travelled and Smart Transport

There are a number of interventions that can encourage people to travel shorter distances. Reducing distance travelled can be achieved through reducing the number of journeys travelled (e.g. by encouraging use of teleconferencing instead of face to face meetings), reducing the distance between a person's departure point and a destination (e.g. using good spatial planning to ensure that people can access services, retail and employment close to their homes) or through ensuring the transport system allows people to travel from one place to another in an efficient manner (e.g. planning bus and tram routes that take people quickly and efficiently to their destination).

Interventions that decrease the distance between a person's departure point and destination are generally long-term interventions. For example, spatial planning can only influence developments that need planning permission, and has limited power to influence the existing layout of cities and towns. Therefore, although spatial planning could have a significant influence on the distance travelled by those living or working in new buildings through encouraging developments in sustainable locations and supporting mixed use developments, it would take some time for this to have a significant impact on the distance travelled of GM residents.

In contrast, schemes that reduce the numbers of journeys people make could be implemented relatively quickly through encouraging work place or community travel plans that discourage travel by unsustainable modes of transport.

Measures to decrease the distance travelled through increasing the efficiency of public transport networks are medium-term interventions as they first require research into GM's travel patterns. One way to collect this data is to develop a scheme similar to the 'Oyster Card' scheme in London. Encouraging people to register for cards that are used to buy tickets on several different modes of transport can provide information about how people travel across GM and combine different travel modes. This knowledge can then be used to improve the efficiency of networks and connections. If implemented effectively, this can help encourage more sustainable modal choices by ensuring that people can get to their destination quicker and more efficiently.

The projections below estimate that transport emissions could be reduced by 9% through reducing the distance people need to travel. However, given that many interventions would be long-term, it is estimated that only a 30% take-up could be achieved by 2020, with a 50% take-up by 2050. It is considered unlikely that take-up could be more than 50% by 2050 because it is very difficult to manage individual travel choices. For example, building a mixed use development does not mean that people who choose to live there will also be the people who choose to work there. It is very hard to mitigate against a situation whereby someone buys a house close to work, but then gets offered a better paid job 45 minutes drive away and chooses to commute.

Reducing the distance GM residents travel could potentially reduce GM CO2 emissions by 0.7% by 2020 and 1.1% by 2050. These figures could be larger if implemented alongside measures to encourage behavioural change.

9.3.7 Renewable and Alternative Fuels for Transport

New technologies have the potential to achieve very large reductions in emissions from transport in the future. Continuing technological development requires the national government to steer the agenda and provide funding for research and development. There are also many national actions around legislation and regulation that could support and encourage people to purchase vehicles that use renewable and low carbon fuels. These are national actions outside GM's control.

However, this section had been included in the GM actions section because there are many actions that GM can do to support this agenda and encourage more sustainable fuels in the area. It should be noted, however, that achieving the reductions suggested here would require some national support.

Developing and promoting the use of greener fuels will produce carbon savings over using ordinary petrol or diesel. Ordinary fuel alternatives include bio fuels, Liquefied Petroleum Gas and Compressed Natural Gas. Biofuels can be mixed with ordinary fuel and used in normal cars. Most of the diesel in the UK, and some petrol, now contains 5% biofuel. Higher proportions of biofuel are suitable in certain cars, or cars can be modified to allow for these larger proportions. Currently in the UK, a small number of filling stations supply blends with a high proportion of biofuel. Increasing the availability of higher blend biofuels and Compressed Natural Gas and developing further greener alternatives will reduce carbon emissions from vehicles able to use these fuels.

Further development of renewable fuels will include developing electric vehicle technology and electrification of railways to cut the carbon emissions from these vehicles. Electric vehicles emit no emissions from the vehicle at point of use, and if the source of the electricity is environmentally friendly they are a more sustainable mode of travel.

The projections below estimate that renewable and alternative fuels could reduce CO_2 emissions by a very significant 30%. This maximum is high because biofuels and electric cars could be very low carbon if the electricity is generated using renewable energy and biofuels are used without any fossil fuels. The amount that electric vehicles reduce CO_2 emissions is highly dependent on the success of grid decarbonisation.

However, the projected take-up is very low (5%) by 2020 because of the need for infrastructure and technological advancements required to support electric cars or pure biofuel cars. For example, the GM grid would likely need significant enhancements to enable widespread use of electric cars; the grid is unlikely to decarbonise very significantly by 2020; and there is not currently a known source of biofuels at an affordable price that could realistically compete with petrol as a main source of fuel for cars. However, by 2050, it is suggested that take-up could be nearer 50%, particularly with significant grid decarbonisation because of the potential for infrastructure development and technological improvements.

Use of renewable and alternative fuels for transport could potentially reduce GM CO2 emissions by 0.4% by 2020 and 3.7% by 2050. However, achievement of these reductions is likely to depend on the success of national actions to research and develop new technologies and/ or decarbonise the grid.

9.3.8 Summary

The graph in Figure 18 shows what all the potential actions would achieve if they were implemented.

Figure 18: Comparison between CO_2 Reductions from Potential Transport Actions and Total Transport Sector Emissions

9.4 What is Happening Already in GM?

9.4.1 Partnership Building

AGMA is developing a Transport Commission which could aid partnership building in GM. There have also been partnerships built between transport bodies, private sector organisations and public sector bodies in GM. For example, Greater Manchester Public Transport Executive (GMPTE) sits on the Energy Group. Maximising opportunities to build on these existing partnerships will be crucial to agree actions to address CO_2 emissions from the transport sector.

9.4.2 Manchester Airport

Manchester Airport is the third biggest airport (by total passenger numbers) in the UK after Heathrow and Gatwick. Manchester Airport has committed to becoming carbon neutral by 2015 for its energy and vehicle use and is undertaking significant actions to reduce CO_2 emissions. For the purpose of this report, emissions from travel to and from the airport would be considered under other transport headings, whilst changes to the airport buildings would be classified as commercial actions. The aviation section above covers only emissions from flights, which are considered to be largely outside GM's control and therefore addressed in the national section[44].

[44] *It should be noted that GM could have a small role in supporting national actions to discourage air travel and in discouraging air travel through measures such as promoting teleconferencing for GM businesses. However, in general it was felt that any actions that would discourage air travel from Manchester airport would be more likely to displace emissions to airports in other parts of the UK than genuinely reduce emissions.*

9.4.3 Metrolink

There is currently significant work underway to upgrade and expand the Metrolink network in GM. GMPTE state that by 2012 four new lines will nearly double the size of the tram network with 20 miles of new track and 27 new Metrolink stops going to Oldham and Rochdale, Chorlton, Droylsden and MediaCityUK. It is estimated that this would result in five million fewer car journeys per year. In May 2009, a fund was agreed for additional lines to Oldham and Rochdale town centres, Didsbury, Manchester Airport, Ashton-under-Lyne and a second route across the city centre. There are further proposed improvements to the trams themselves and passenger facilities, and proposed driver training courses to reduce CO_2 emissions from trams. All these changes could significantly influence modal choice by providing GM residents with a viable alternative to driving into the city centre.

9.4.4 Bus Service

GM is also using assistance from the Government's Green Bus Fund to purchase low-emission vehicles. The fleet will use diesel-electric hybrid vehicles which also incorporates an 'Eco Drive' system which encourages optimal driver behaviour. The current order consists of 20 metroshuttle vehicles, 30 buses for the general fleet and 16 school buses. The metroshuttle vehicles will enter into passenger service in autumn 2010 with remaining vehicles phased in from January 2011.

9.4.5 Electric Vehicles

GM also submitted a bid to receive 'Plugged-In Places funding' from the Office for Low Emission Vehicles Department to create a critical mass of infrastructure in cities and regions around the UK to support the early market for electric vehicles. Although GM was unsuccessful in first round, GM is currently putting together a full application for the second round (due 30 September). This could result in funding for refuelling/ recharging infrastructure across GM.

9.4.6 Walking and Cycling

A number of activities have been taking place in GM to encourage walking and cycling, including provision of a number of off road cycle facilities in GM. In 2009, a report concluded that recorded cycling levels in Manchester City Centre had increased by 50% between 2005 and 2009.

There have also been a number of Town Centre pedestrian schemes that could potentially encourage people to choose more sustainable modes of transport.

9.4.7 Digital Ticketing

GMPTE and partners have been developing plans for an integrated digital ticketing system for Greater Manchestery and have received funding from the Department for Transport to implement a Smartcard Scheme for Metrolink. The first phase of this scheme will be delivered in Summer 2011. The scheme will include a smartcard that can store money or ticket products, similar to the Oyster card scheme in London.

9.4.8 Travel and Transport Planning

The ten LAs of GM have been encouraging travel planning in their areas through:

Requiring new large developments to submit an outline travel plan with their planning applications and update it when the development is complete; and

Implementing travel plans for Council services (i.e. schools, hospitals, Council offices).

This could contribute to more sustainable travel choices if implemented with the buy-in of employees.

The Transport Act 2000 introduced a statutory requirement for local transport authorities to produce a Local Transport Plan (LTP) every five years and to keep it under review. The last Local Transport Plan was submitted in March 2006 and covers the period up to 2011. The GM Integrated Transport Authority is currently preparing the next LTP for the period 2011 to 2016 and will set out how transport will be better managed and improved to support delivery of wider strategies such as the GM Strategy. One of the priorities of the current LTP is to reduce transport's contribution to CO_2. Further, GMPTE are currently developing a Climate Change Strategy, although no drafts were available at the time that this report was produced.

9.5 Recommendations for Action

It is clear that many bodies, such as the GMPTE, are carrying out activities that could constrain and reduce CO_2 emissions from transport in GM. However, it was not possible to gain detailed information on what these actions were, or what the potential impact might be on GM emissions.

Therefore, some priority actions are focused around gaining a better understanding of the existing and proposed schemes for transport in GM and building partnerships to reduce CO_2 emissions from transport through actions in future SEAP reports. Other actions are proposed through baseline research, and the potential viability and implementation of these actions should be discussed with transport bodies and operators in GM to ensure proposals are deliverable.

9.5.1 Partnership Building

Enabling Action

Engage and build better partnerships with transport stakeholders in GM, particularly GMPTE.

Engaging and building partnerships with transport stakeholders in GM should be a priority action for the SEAP report because it will:

Enable GM to gain a greater understanding of current transport actions;

Build understanding of the impact actions could have on emissions from transport; and

Assist in the development and evolution of priority actions that are deliverable, have identified actors and consider the aspirations of transport stakeholders.

At present, there relatively limited engagement that the sustainable energy action planning process has had with transport stakeholders can be seen as a barrier to development of an integrated approach to understanding and reducing CO_2 emissions in GM.

9.5.2 Electric and Low Carbon Vehicles

Primary Action

Encourage and support use of electric, hybrid and ultra low emission vehicles.

The following steps to implementation are suggested to encourage and support use of electric, hybrid and ultra-low emission vehicles:

1) Support and concentrate short-term efforts on **submitting a successful Plugged-in Places bid** for funding for infrastructure to charge electric vehicles. Given the short timescales for this, this should be one of the first SEAP report priorities.
2) Learn from **experience in areas that gained Plugged-in Places funding** (i.e. London, the North East region and Milton Keynes) to understand the most effective ways to implement charging infrastructure.
3) Encourage integration of **charging points into key locations around GM** (e.g. shopping centres and sports venues), potentially using knowledge and funding from steps 1 and 2. If steps 1 and 2 are unsuccessful, a priority will be to identify other best practice case studies and funding sources for new infrastructure.
4) Consider developing consistent **GM planning requirements for recharging points** in new developments. It should be noted that some LAs are already considering these requirements so the focus should be on ensuring consistency across GM.
5) **Engage with Electricity North West** to discuss the relationship between the existing electricity network and potential future changes to electricity demand due to use of electric vehicles. This should include consideration of:
    a) Scenarios for electricity network improvements to ensure it can cope with charging patterns for electric vehicles;
    b) Scenarios for mitigating need for network improvements by utilising Smart Grid technologies to manage the demand from electric vehicles[45];
    c) Advice that should be given to businesses, communities and public transport bodies considering increasing use of electric or low emission vehicles (e.g. in the short-term should companies purchase vehicles that recharge over a short/ long time period); and
    d) Plans for implementing any necessary upgrades.

Primary Action

Increasing use of alternative (non-electric) fuels in vehicles.

This action could be implemented through engagement with transport stakeholders on potential research in this area and discussion on potential interventions

[45] *Another potential way to tackle the issue is to attempt behavioural change so that vehicles would not all need to charged at the same time. For example, if organisations are encouraged to be more flexible about their work starting and finishing times this could stop everyone charging their vehicles at the same time (as well as reducing the stress on public transport systems in peak hours).*

9.5.3 Smarter Travel Choices

Primary Action

Encourage people to make smarter travel choices.

The following steps are recommended to help people make smarter travel choices in GM:

1) Define the nature of groups who will be targeted with programmes to change their travel behaviour through:
   a) Collating and evaluating research developed to inform Travel Plans across GM to develop baseline information on who travels using different modes of transport and why they choose that mode; and
   b) Identifying target groups who currently use less sustainable modes of transport and whose reasons for their choices can be influenced by interventions at the GM level.
2) Develop a programme of intervention that is designed with the target group in mind and tackles the perceptions that lead to their current travel choices. These interventions could include:
   a) **Communications tools:** Advertising campaigns that promote the benefits of sustainable transport choices, addressing misconceptions (e.g. if people do not use buses in their areas because they perceive them as unreliable, use campaigns that publicise the reliability compared to alternative modes). However, care should be taken to ensure that campaigns focus on genuine benefits as otherwise campaigns can lead to negative publicity;
   b) **Economic instruments:** Changes to the relative cost of one mode of transport compared to another to encourage behavioural change. This can either involve subsidies to public transport or increased costs for car drivers (e.g. congestion charging or parking charges);
   c) Measures to **increase the perceived control** a person has over their journey. This could include use of 'real time' information at bus stops, increasing publicity of information web-sites (e.g. GMPTE journey planner) and use of advertising focusing on the comparative reliability of different transport modes (e.g. cycling compared to a car);
   d) **Infrastructure provisions:** Improvements to public transport fleets and cycling/ pedestrian infrastructure to tackle any negative perceptions (e.g. upgrades to trams, buses and trains if perceptions are that the vehicles are uncomfortable or lighting at bus stops to increase perceptions of safety); and
   e) Potentially set out all of the above in co-ordinated travel plans for particular areas (e.g. city centres, LA areas or across GM).
3) **Using research to inform other improvements to public transport and/ or walking and cycling infrastructure** such as increasing mode capacity or changing public transport routes.
4) **Evaluate** implementation and the impact interventions have had on behaviour to inform future investments and behavioural change programmes.

9.5.4 Maintenance and Fuel Efficient Driving

Primary Action

Encourage car drivers to maintain vehicles and drive more efficiently.

The following steps are recommended to reduce CO_2 emissions through driver efficiency and vehicle maintenance:

1) Development of a programme to promote vehicle maintenance and efficient driving. Some ideas that could be incorporated include:
   a) Workshops for driving instructors in GM on how to teach fuel efficient driving. Potentially implemented with provision of 'on board consumption meters' for vehicles used by driving schools;
   b) Education programmes providing information about how to drive more efficiently and how to tell when your vehicle needs maintenance to increase fuel efficiency. This could be marketed through raising awareness of the potential reductions in fuel costs; and
   c) Consideration of funding sources to obtain on board consumption meters for use in education programmes.

9.5.5 Mode Capacity and Smart Transport

The following steps should be taken to increase mode capacity and implement route upgrades to ensure that the demand for public transport can be met whilst decreasing CO_2 emissions from transport:

1) Consideration of an approach that would enable collection of data on transport choices to inform future changes to mode capacities, route changes and infrastructure upgrades. This could incorporate an expansion of the digital ticketing system currently under development by GMPTE and partners.
2) Engagement with transport operators and other stakeholders to identify opportunities and barriers to public transport upgrades and develop interventions based on this research in partnership with stakeholders. Design of services could be aided by consultation with consumers as well as those owning or operating services. Interventions could include:
    a) Further Metrolink extensions;
    b) Provision of larger, greener buses, trams and trains;
    c) Changes to bus routes or stops to meet demand;
    d) Increasing or decreasing frequency of certain services; and
    e) Design of safe, direct, convenient cycle and pedestrian routes connecting homes, businesses and key retail and service locations.

9.5.6 Reduce Distance Travelled

The following steps should be considered to reduce distance travelled:

1) Potentially use integrated travel plans to inform spatial planning approaches to transport across GM;
2) Use research and recommendations developed through past and future decentralised energy studies to inform land use planning policy making that reduces the need to travel[46];
3) Encourage travel planning by businesses located in GM to investigate potential CO_2 reductions resulting from:
    a) Use of communications technologies instead of travelling to meetings. This could minimise travel be all modes of transport, including aviation[47]; and
    b) Supporting flexible working patterns so staff can work from home or from locations closer to home than their main office[48].
    4) Consider whether measures to reduce distance travelled can be promoted alongside residential actions below.

[46] *It should be recognised that reducing the need to travel has been a key area for spatial planning for some time and that most current and emerging planning documents already contain policies aiming to reduce distances travelled.*

[47] *Although aviation is not included in SEAP report targets, it would be beneficial to reduce aviation emissions through this action*

[48] *It should be noted, however, that home working can increase CO_2 emissions if it means that staff are all heating and lighting their own homes as opposed to using one office. Transport emissions would only be reduced if staff did not use their increased level of flexibility to travel to other locations (e.g. drive to visit a friend at lunch-time), or use less sustainable modes of travel (e.g. when people choose to drive to work because their increased level of flexibility means they can afford parking charges for the days they are in the office).*

Section 10
Demand Reduction Actions in the Residential Sector

10.1 Introduction

The residential sector generates 36% of GM's CO_2 emissions and represents an area where quick-wins could be achieved in delivering both CO_2 emission reductions and a low carbon economy. GM has a large proportion of social housing and a track record of successful regeneration projects that could support GM in becoming an international centre of excellence for development of a low carbon residential sector (and the built environment in general). GM's LCEA programme has already started scoping out actions for the residential sector and supporting these actions is a main priority for the SEAP report.

10.2 Potential National Actions

The previous Government set in motion plans to progressively improve the energy efficiency standards for new homes as set out in Building Regulations. The Policy Statement 'Building a Greener Future' stated that new homes should be net zero carbon from 2016. To work towards this aim, the Government improved energy efficiency standards for domestic properties in Part L of the Building Regulations by 25% in 2010 relative to 2006 standards, and aimed to improve standards by 40% compared to the same baseline in 2013.

10.3 Potential GM Actions

The emission savings achievable via the following actions have been developed using data from the Energy Savings Trust. These figures, adjusted to reflect the phased implementation of such measures over time, have been used to quantify the impact on total GM CO_2 emissions.

10.3.1 Insulation Improvements

Improvements reviewed include the following energy efficiency measures:

- Virgin loft insulation;
- Loft top up insulation;
- Cavity wall insulation; and
- Solid wall insulation.

Potential GM emissions savings by 2020 have been projected at 3.7%, with corresponding savings by 2050 predicted at 4.6%..

10.3.2 Low-Energy Lighting

The incorporation of low energy lighting into existing properties represents a low-cost method for reducing residential electricity consumption.

Associated GM emissions savings possible by 2020 via low-energy lighting are projected at 0.3%, with this figure predicted to reach 0.4% by 2050.

10.3.3 Draught Proofing

Draught proofing is predicted to provide similar levels of energy saving and associated emission reductions as low energy lighting.

Achievable GM emissions savings by 2020 are 0.4%, rising to 0.5% by 2050.

10.3.1 Boiler Replacements

The age and associated efficiency of existing gas-fired boiler plant has a major impact on residential energy use for heating.

The replacement of old boiler with more efficient plant is expected to provide GM with emission savings of up to 1.6% by 2020. Continuation of a replacement programme could result in total savings of 2.7% by 2050.

10.3.5 Double-Glazing Installation

Another factor in the overall energy requirement of residences is the amount of heat loss which occurs through building fabric. In addition to wall and roof insulation, the replacement of old windows and frames with double-glazing provides an opportunity to reduce these heat losses.

Glazing improvements are predicted to provide GM emissions savings of up to 1.1% by 2020 and 2.7% by 2050.

10.3.6 Behavioural Change

In addition to physical alterations to existing residence construction and plant, energy and related emissions savings may be derived with no or low associated costs via behavioural change. Behavioural change can be encouraged or instigated via the installation of smart meters and could result in heating and electricity savings of as much as 10% throughout the sector[49].

Smart meters could also help people to make informed decisions on when they use electricity, potentially linked to pricing structures that charge higher prices when demand is high.

This could help support management of a distribution network that depends more heavily on renewable and low carbon sources of electricity.

Such measures could provide GM emission savings of up to 3.1% by 2020 and 3.9% by 2050

10.3.7 Summary

The graph in Figure 19 shows what all the potential actions would achieve if they were implemented.

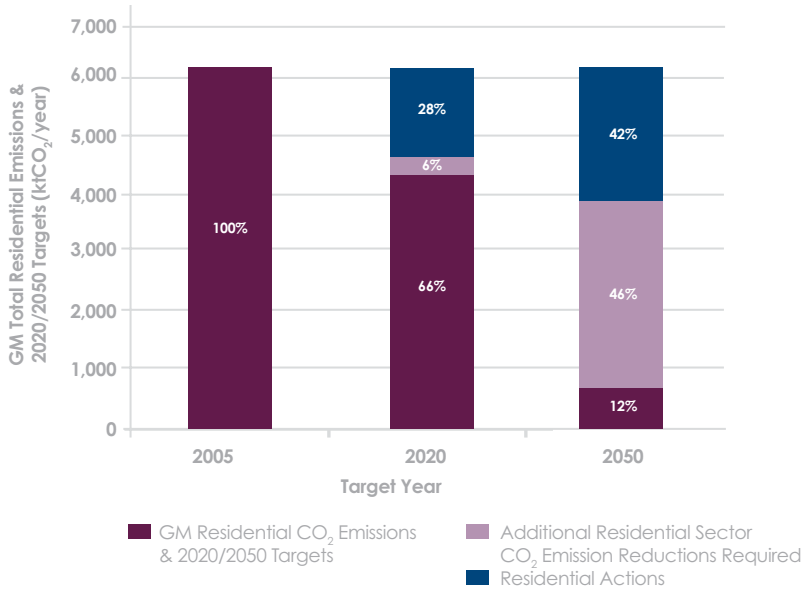


Figure 19: Comparison between CO_2 Reductions from Potential Residential Actions and Total Residential Sector Emissions

[49] *The figure of 10% is taken as it is advised as an appropriate goal for energy conservation behavioural change programmes in Intelligent Energy Europe (2010). However, estimates of CO_2 emission savings resulting from behavioural change vary significantly between studies and research documents. Therefore, this figure should be re-visited in the context of initial research and actions on behavioural change in the GM context.*

10.4
What is Happening Already in GM?

The LCEA programme can contribute to the reduction of CO_2 emissions from the residential, commercial and industrial sectors. Therefore, the contributions are also discussed in the commercial and industrial sections in this SEAP report. This new designation for GM heralds a five-year programme of domestic and commercial retrofit, low-carbon generation and Smart Grid development that will support 34,800 low carbon jobs in GM and save up to 6 million tonnes of CO_2 (AGMA 2010).

The LCEA objectives relevant for the residential sector are:

- Creating the investment and delivery vehicles required to undertake the physical retrofit of both public and private sector housing;
- Reducing carbon emissions within the residential sector by retrofitting 75% of homes;
- Creating a delivery structure that sets GM on a trajectory to meet UK carbon reduction targets; and
- Strengthening the spatial planning framework so that by 2016 all new residential developments will be zero carbon.

Within five years, the programme aims to create a self sustaining market in retrofitting. The programme is aimed at aiding a transformation to a low carbon economy and is an economic development programme focused on maximising economic benefits to GM.

The LCEA is likely to establish a governance structure to co-ordinate the delivery of LCEA objectives, positioning GM as the international exemplar of reducing carbon in the built environment. Ernst and Young (2009) concluded that the LCEA programme could save 6 million tonnes of CO_2 by 2015.

Complementary to cross-sector housing renewal and improvement programmes the Energy Saving Trust (EST) provides a range of services to target the reduction of energy demand and stimulate micro generation. Lifetime savings from the EST's 2009-10 programme are estimated at 12,350 tonnes of CO_2 (AGMA 2010).

The EST has completed significant work at the UK level publicising ways of saving energy in the home and providing information that can be used to support community education programmes aimed at encouraging behavioural change.

They also may be able to provide information on case studies that can be used to educate GM residents about behavioural change. LAs in GM have also held a number of road shows and implemented community education programmes on saving energy. For example, Tameside Council has been running roadshows across the borough to inform and raise awareness on energy efficiency and recycling and Manchester plan to launch the 'two degree challenge' which aims to encourage residents to turn down thermostats during the summer months.

Recent Research at the University of Manchester (Rediscovering the Civic and Achieving Better Outcomes in Public Policy) has found that light touch interventions or "nudges", like canvassing, providing feedback and asking for a pledge can, when implemented carefully, successfully lead to behavioural change. This research is further corroborated by action taken by Manchester is my Planet to deliver changing behaviour project called the "Energy Academy" in partnership with the EST, Action for Sustainable Living and Trafford Borough Council[50].

LAs and Housing Associations have also been taking the initiative and delivering programmes in GM to retrofit residential buildings. Some of these projects are set out in LA's own plans, for example, Manchester City Council's Climate Change Action Plan states that Manchester aims to save over 350,000 tonnes of CO_2 a year by 2020 through a major programme of retrofitting domestic buildings.

Finally, a significant body of work has been completed looking at the potential for a consistent approach to planning for new developments across GM, potentially through the development of an Energy Spatial Plan. This work has been carried out as part of the DES study, with subsequent engagement with planning authorities across GM. Some LAs have also been carrying out their own, more detailed energy studies.

10.5
Recommendations for Action

A large number of recommended actions will come forward as part of the LCEA programme, and therefore the LCEA is identified as the actor likely to co-ordinate delivery. The following section therefore summarises actions likely to come forward as part of the LCEA programme and includes recommendations on how to add value to these actions.

[50] *The Energy Academy project is part of the European Union 7th Framework Programme, for more information go to www.manchesterismyplanet.com*

It is likely that the LCEA programme will evolve rapidly over the coming months and the SEAP report can provide evidence to support this.

There will be different strategies for private and public sector housing, and for owner-occupied and rental housing to reflect the different issues in delivering solutions. For all sectors a key issue is gaining finance and funding for implementation. In the public sector national standards are being set to enhance the performance of social housing, but funding remains a barrier to wider adoption of retrofitting solutions.

10.5.1 Roll-out of a Domestic Retrofitting Programme

A comprehensive roll-out of measures to retrofit domestic buildings to reduce heat and electricity demand can be carried out alongside measures to encourage behavioural change (described in Section 10.5.2) and measures to encourage micro-generation. However, as these actions reduce CO_2 emissions in different ways, and may well be funded and delivered using different mechanisms, they have been separated here to add clarity.

Primary Action

Comprehensive roll-out of programme to retrofit domestic buildings with technical solutions that will reduce heat and electricity demand.

The retrofit of measures to reduce heat and electricity demand could be implemented using the following steps:

1) Development of a **business plan** as part of the LCEA programme that sets out the most cost effective interventions, or a comprehensive roll-out of the following for private sector and social housing (potentially involving two separate strategies, one for the social sector and the other for the private sector). A first step in this process could involve the development of a comprehensive map of the housing stock in GM, identifying what measures are suitable for which areas.

   A programme of interventions could include:

   - Cavity wall and loft insulation;
   - Solid wall insulation;
   - Replacement of inefficient boilers;
   - Installing heating controls to enable residents to set timers and change the temperature in different rooms of the house;
   - Low energy lighting; and
   - Any other measures deemed appropriate.

2) **Establishment of a funding and financing model for delivery** of the above. The models are likely to differ for social sector housing, homes in private ownership and privately rented housing. There may also be a different approach for apartments. The LCEA will have a role to play in supporting the social housing sector to access funding for retrofitting and organisations like GM Procure may be able to support with procurement efficiencies across the sector. Implementation measures could include:

   a) Capturing available carbon pricing mechanisms such as Community Energy Saving Programme[51];

   b) Providing regulation, advice, incentives and investment models to help home owners and private landlords finance projects. This could include establishing 'green leases' as an incentive to retrofit and share benefits between landlords and tenants and investigating development of green clauses in LAs' Landlords' Accreditation Scheme. Ideally, LAs would find a way of making Accreditation schemes mandatory so that increased requirements do not just discourage landlords from taking part in the scheme[52];

   c) Approaching financial institutions to finance schemes across GM; and

   d) Monitoring the national context and sources of funding delivered through schemes such as the 'Pay as you Save' scheme, through general actions to co-ordinate responses to funding.

[51] *The Community Energy Savings Programme was a programme created by the previous Government, requiring gas and electricity suppliers and electricity generators to deliver energy saving measures to domestic consumers in specific low income areas of Great Britain. It was designed to promote a 'whole house' approach and treat as many properties as possible in defined areas.*

[52] *Currently Landlord Accreditation schemes are voluntary, therefore, measures that make the Accreditation harder to achieve could simply discourage landlords from applying for accreditation rather than raising standards. Introducing a way for schemes to become mandatory, or some incentive linked to achievement of accreditation could help to combat this.*

3) Development of **supply chains** for materials to implement step 1, focusing on opportunities to support local businesses;

4) Delivery of the support packages for property owners responding to different occupancies, house type and financial circumstances;

5) Programme to **promote** the package across GM, potentially included Area Based approaches, and community engagement;

6) Setting whole house standards as part of **consents for building modifications** through the planning system and as part of area based regeneration schemes; and

7) Incorporate measures to **evaluate** the success of LCEA interventions in reducing CO_2 emissions in GM, including the development of best practice case studies. Use this information to promote GM as a centre of excellence for the built environment to other UK and European cities. This will help maximise economic benefits through selling GM's expertise in the sector. Evaluations can also feed back into monitoring of the progress of actions identified in the SEAP report.

When implementing the above, it should be recognised that the programme will need to be repeated more than once for each house before 2050 to reflect economic and technological change.

10.5.2 Behavioural Change to Reduce Electricity and Gas Use

Primary Action

Encourage Behavioural Change That Will Reduce Demand For Electricity And Gas In Domestic Properties In Gm.

This action could be implemented using some, or all of the following:

1) Provision of smart meters to provide information to householders on energy use, preferably provided as part of the whole house approach above. Implementation could involve:

   a) Identification of supply chains to obtain affordable smart meters that are easily installed in GM housing;

   b) Identification of funding mechanisms for installation of smart meters in homes. Alternatively, smart meters could be offered on loan, or at cost to homes to assist residents in reducing their energy costs and CO_2 emissions; and

   c) Promotional material on how to use smart meters and the potential cost savings resulting from their use (preferably using GM examples). This could highlight the most energy intensive appliances in the house and the savings associated with reducing energy use (e.g. cost of boiling a full kettle compared to one with enough water for one cup of tea).

2) Education programmes in schools on reducing electricity and gas use. This could be implemented using smart meters given on loan to schools for children to use at home and report back on energy savings achieved. Energy savings could be achieved through measures such as turning the heating down, shorter showers, switching appliances off when not in use and so on.

   Competitions could be held for the highest energy savings achieved over a dedicated time period, or innovative energy savings measures developed by the children.

In Spain a recent study suggested that switching off the TV rather than leaving it on standby could save 40million Euros and avoid 300,000 CO_2.

3) Use local expertise (e.g. GM Energy Savings Trust Advice Centre and Manchester is My Planet) to develop community advertising campaigns around energy and gas use. This could involve road shows on energy use, provision of advice on domestic energy efficiency and publicising case studies of streets or communities who have managed to reduce their energy use. Implementation could involve:

   a) Compiling a compendium of different advertising and promotional schemes and seeking out examples that can demonstrate significant behavioural change;

   b) Use GM Energy Trust Advice Centre to help shape effective programmes and draw on experience from other areas;

   c) Sharing experience on behavioural change and implementing promotional campaigns to publicise interventions that have been the most successful; and

d) Designing campaigns that involve 'evaluation criteria' that assess the effectiveness of interventions to inform future interventions. Ideally, feedback should be given to people to illustrate what their interventions are achieving through use of smart meters, or potentially changes to utility bills that emphasise how your energy use compares to energy use in a previous year or similar properties.

In Spain a recent study suggested that switching off the TV rather than leaving it on standby could save 40million Euros and avoid 300,000 CO_2.

10.5.3 Developing Planning Policies to Require Zero Carbon Residential Developments by 2016

If the planned tightening of Building Regulations occurs in 2013 and 2016, there would not be a need for planning authorities to additionally set policies requiring developments to meet these standards. However, no firm commitments have been made to tightening Building Regulations past 2013 and the change of Government introduces further uncertainty in how Building Regulations will change over the next few years. Further, if Building Regulations are changed to require new developments to be zero carbon by 2016, this would require a significant improvement from 2013.

If policies are clearly set out in planning documents, the development industry will have more certainty that these standards will be required in GM, and this may encourage early development of skills and interventions to meet these requirements. This could have future economic benefits if these skills can then be marketed outside GM.

Therefore, there could be merit in developing planning policies that require progressively higher energy efficiency standards to:

- Provide a gradual increase in energy efficiency standards in the years in which Building Regulations are not recommended to change (so there is not a rush of Building Regulation applications in 2012);
- Provide more certainty on requirements whilst the new Government forms a stance on changes post 2013;
- Encourage standards to be adopted earlier than that set out in Building Regulations (e.g. improvement of 60% by 2013) to prepare GM for increasing standards and promote GM as a centre for innovation in this area.

Primary Action

Encourage development of consistent planning policies that require all residential developments to be zero carbon by 2016.

To implement this action, it is recommended that GM consider:

1) Continuing discussions on the establishment of an Energy Spatial Plan that could recommend consistent approaches to new developments. This could include requirements to deliver higher energy efficiency standards ahead of Building Regulations changes and/ or include the target for homes to be zero carbon by 2016; and

2) Considering how to support the development of the skills and knowledge required to enable developers in GM to meet higher energy efficiency standards for domestic buildings.

Section 11
Demand Reduction Actions in the Commercial and Services Sector

11.1 Introduction

The commercial and service sector consumes a significant proportion of GM's energy and, due to a bias toward electricity use, currently accounts for 36% of GM's CO_2 emissions. As with the residential sector, the LCEA designation and work programme suggests actions that aim to reduce CO_2 emissions from commercial and service sector buildings. The commercial and services sector is a relatively broad sector covering emissions from all non-domestic buildings (e.g. universities, retail, restaurants, bars, schools, hospitals and other public sector buildings). This sector also includes infrastructure that would be billed to utility companies as a business or public sector account such as street lighting.

11.2 Potential National Actions

Many of the national actions with a potential impact on CO_2 emissions are similar to those discussed other report sections, namely:

- Targets for all new schools to be zero carbon by 2016; and
- Targets for all non-residential buildings to be zero carbon by 2019.

11. Potential GM Actions

The potential energy savings resulting from the following actions have been estimated in terms of their impact on total GM emissions.

11.3.1 Energy Efficient Lighting

The replacement of older light fittings and systems with lower energy options can reduce electricity consumption in commercial and service sector buildings.

Overall GM emission savings from energy efficient lighting in the commercial and service sector could be up to 0.7% by 2020 and 1.4% by 2050.

11.3.2 Modify Building Heating Set Points

Energy used to generate heat can be saved simply via the widening of heating (and cooling) set points for commercial and service sector buildings featuring building/energy management systems linked to internal temperatures. For example; building heating systems could be set to operate once internal temperatures reduce below 18 or 19°C rather than 20 or 21°C without perceptibly altering the comfort levels for occupants.

GM emissions saving from modification of commercial and service sector building heating set points are estimated at 2.8% by 2020 and 5.5% by 2050.

11.3.3 Night-Time Cooling

The electrical consumption associated with cooling commercial and service sector buildings can be reduced by overnight "free" cooling via the natural ventilation/ exhaustion of warm air. This can reduce the amount of energy used to cool air during occupied hours.

GM emission savings achieved by introducing night-time cooling into commercial and service sector buildings are estimated at 0.7% by 2020 and 1.3% by 2050.

11.3.4 Time Switches on Small Equipment

Referring chiefly to office equipment and other small power consumers, time-switching providing automated shutdown has been demonstrated as a low cost method to provide electricity consumption savings.

Overall GM emissions saving from appropriate time-switching are estimated at 0.2% by 2020 and 0.3% by 2050.

11.3.5 Behavioural Change

Occupants of commercial and service sector buildings may not be able to influence the entirety of their shared energy use in the way that owners or occupiers of residential properties can. However, behavioural change can still lead to energy and CO_2 emission savings, particularly in relation to electricity consumption via small power usages. Such measures are predicted to provide electricity savings of up to 10%, in addition to the savings already described in relation to more centrally controlled systems such as lighting and cooling.

Behavioural change measures are predicted to provide GM emissions savings of up to 1.9% by 2020 and 2.4% by 2050.

11.3.6 Summary

The graph in Figure 20 shows what all the potential actions would achieve if they were implemented.

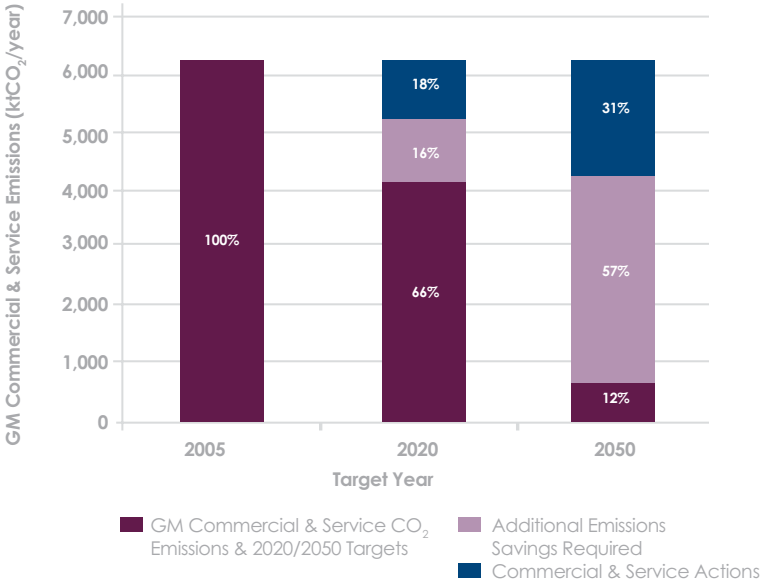


Figure 20: Comparison between CO_2 Reductions from Potential Commercial and Service Sector Actions and Total Commercial and Service Sector Emissions

11.4 What is Happening Already in GM?

The LCEA also contains aims and objectives relevant for the commercial and service sector, including:

- Creating the investment and delivery vehicles required to undertake the physical retrofit of both the public and commercial sectors; and
- Aiming for all non-residential new developments to be zero carbon by 2019.

A large number of businesses and public sector organisations throughout GM are implementing interventions to reduce CO_2 emissions from their activities and buildings. The SEAP report does not attempt to provide a comprehensive review of these actions. However, the following are examples of organisations implementing interventions in GM:

- Manchester Corridor Businesses and Institutions: The businesses and institutions that occupy 'Corridor Manchester' have formed the Corridor Manchester partnership to drive future economic growth and investment. Corridor Manchester stretches from St. Peter's Square to Whitworth Park in central Manchester. It covers the University of Manchester, Manchester Metropolitan University and the Central Manchester University Hospitals NHS Foundation Trust.
- Five high-level indicators have been used to benchmark Corridor Manchester internationally, of which one relates to environmental sustainability (including CO_2 emission reductions). As part of the Corridor Manchester work, and the Low Carbon Laboratory described in the general actions, the institutions aim to reduce CO_2 emissions through energy efficiency measures.

[53] *The figure of 10% is taken in the absence of robust evidence to suggest the levels of reductions achievable from this sector. It may be that future SEAP reports are able to source data to make a more accurate prediction for emission savings through behavioural change measures.*

This includes significant actions by Universities and businesses along the Corridor.

- LA Actions: Three LAs have adopted National indicator 185, committing to reducing CO_2 emissions from their own stock. Many LAs have also begun to implement actions to reduce CO_2 emissions from their own activities, for example, Oldham, Rochdale and Tameside have installed more energy efficient street lights and highway columns to reduce energy use.
- Manchester Airport: The Manchester Airport Masterplan states that the airport aims to be carbon neutral by 2015[54]. For example, the Masterplan aims to increase energy efficiency in airport buildings.
- Bruntwood: Bruntwood have been implementing retrofitting schemes in a selection of office buildings in Manchester City Centre (e.g. installing energy efficient lighting).

The EST and Envirolink have been working to support business actions to reduce CO_2 emissions in GM, including supporting information sharing, the development of developing best practice case studies and establishing networks to discuss supply chains and particular issues (e.g. Smart Grids and energy efficient lighting).

11.5 Recommendations for Action

There are several commercial and public sector organisations in GM who are taking action to reduce CO_2 emissions from the commercial and service sector. However, engagement and research conducted as part of the sustainable energy action planning process suggests that actions have been more modest than in the residential sector.

11.5.1 Education and Information Sharing on Commercial Retrofitting

There is a need for actions around education and information sharing on commercial retrofitting. This is needed because:

- In comparison to the residential sector, commercial and service sector buildings are very diverse in terms of their design, use, size and building materials. This makes it harder to roll out interventions or apply previous experience;
- Commercial and service sector buildings are often owned, managed and occupied by different organisations. This can make it more difficult to implement interventions as the organisation making the investment is not necessarily the same organisation as will make the cost savings[55];
- There is a lack of information on best practice commercial and service sector retrofitting projects; and
- Commercial and service sector organisations might not always be as willing to share experience if it means they are sharing research with competitors.

Enabling Action

Education and information sharing on retrofitting commercial and service sector buildings with measures to reduce CO_2 emissions

These following steps could be undertaken to implement the above action:

1) Identify best practice commercial and service sector retrofitting projects in and around GM and use these to promote information sharing and innovation;
2) Organise education workshops on commercial and service sector retrofitting, this could include:
   a) Regular workshops for like minded individuals focused on very specific issues (e.g. insulating office blocks); and/ or
   b) An annual conference covering different aspects of retrofitting, with guest speakers who have carried out retrofitting projects in similar situations elsewhere.
3) Map expertise and networks in GM, building on work that the Joule Centre and Salford University have done in developing information pools. This would assist businesses and organisations in locating assistance with retrofitting projects and promote information sharing.
4) Envirolink have set up small groups on specific issues such as LED lighting and smart meters. These are small group workshops of 20 people discussing specific issues. Supporting these groups and providing them with contacts for further information or advice could help.

[54] *This target is for ground activities and does not consider emissions from aviation.*

[55] *Of course, this is also true of rented accommodation, but there are more schemes like Decent Homes that encourage retrofitting in the residential sector and there may be more rented properties in the commercial sector than the residential sector.*

11.5.2 Funding and Finance

A major issue around the delivery of commercial and service sector projects is the access to funding. The main issues are that:

- There is a lack of awareness of the funding available for retrofitting commercial and service sector buildings;
- Funding applications often involve a large time and cost investment. This is difficult to justify, particularly in the private sector.
- To obtain funding, it is often necessary to provide information on the CO_2 savings per £. This is difficult because:
  - Organisations often do not have the expertise and knowledge to calculate this; and
  - It is sometimes difficult to gain this information (e.g. if there are no local supply chains for the interventions it is difficult to obtain data on costs).
- Private sector finance is often only obtainable for low risk, high return projects. As there is less experience around commercial and service sector retrofitting projects and they often involve new and emerging technologies, they are seen as higher risk projects. Therefore, private sector finance is often unavailable or only available at a high cost.

Enabling Action

Ensure that the actions on finance and funding include actions to support commercial and public sector retrofitting projects.

Actions to achieve funding for commercial and service sector retrofitting should be addressed through the general funding actions, but with an emphasis on addressing particular concerns of this sector. Actions could also be taken to develop a database of information on funding for the commercial sector (e.g. CO_2 savings per £ for triple glazing) to support interventions.

11.5.3 Behavioural Change to Reduce Energy Use in Commercial and Service Sector Buildings

It is recommended that an approach be developed to encourage behavioural change towards increasing energy efficiency in commercial and service sector buildings.

Primary Action

Encourage behavioural change to reduce energy use in commercial and service sector buildings.

Development of a programme would follow similar steps as for encouraging smarter travel choices in Section 9.5.3. In other words the programme would aim to:

- Define groups to be targeted based on an understanding of who uses energy in buildings and consequently and whose behaviour could be changed;
- Develop a programme of intervention designed with the target group in mind;
- Use research to inform other improvements to buildings and interventions (e.g. if people are not aware of the energy they use, this could be aided by smart meters and sub metering of buildings); and
- Evaluate implementation to inform future behavioural change programmes.

This could potentially be a cost-effective action that would also bring economic benefits by reducing overhead costs for businesses in GM, increasing competitiveness. It should be noted that often the occupiers of buildings do not pay their utility bills as these are paid by the owner or management company. One way to change this could be to encourage management companies and/or landlords to reflect energy use in their rental costs over time. This would need to be implemented with care to ensure that this did not have negative impacts on businesses, and would probably need to be aided by sub-metering of office blocks and potentially smart meters.

Actions could also be encouraged through encouraging businesses to adopt Environmental Management Systems (EMS) and identifying ways to encourage behavioural change through EMS actions. Education for employees and maintenance staff could also form part of these actions where a lack of information on how to use buildings efficiently is a barrier to progress.

11.5.4 Retrofitting Commercial and Service Sector Buildings

Primary Action

Implement demonstration commercial and service sector projects in GM.

The following steps could be undertaken to support this action:

1) Develop partnerships with Universities through the Low Carbon Laboratory and potentially Salford University's 'Salford House'[56] to test technologies and interventions;
2) Identify potential demonstration projects with willing partners. Demonstration projects would preferably include a range of different uses and interventions. This could involve learning from projects already in the pipeline (e.g. Corridor Manchester projects) as well as identifying additional projects;
3) Identify funding and finance for demonstration projects and ensure that there are some processes built in to evaluate the impact of the interventions;
4) Deliver demonstration projects and publicise them as case studies to promote information sharing; and
5) Use evaluative information to inform a more comprehensive retrofitting programme for the sector.

Primary Action

Roll out a commercial and service sector retrofitting programme.

This action would draw upon experience from the demonstration projects above to develop a more comprehensive retrofitting programme. The final programme would likely include:

- Reducing heat demand using technical solutions (e.g. upgrading boilers, insulating buildings, installing double glazing and fitting draft excluders);
- Reducing electricity demand using technical solutions (e.g. intelligent lighting systems and automatic switch-off for electronic devices[57]); and
- Incorporation of additional/new technologies developed through demonstration projects where these result in CO_2 savings (e.g. this could include considering the potential of voltage optimisation for energy savings and the use of hot water storage systems or high thermal mass buildings with concrete as thermal stores).

11.5.5 Higher Standards for New Commercial and Service Sector Buildings

As with residential buildings, there is a role for planning departments in encouraging the development of low carbon buildings in advance of mandatory changes introduced through building regulations.

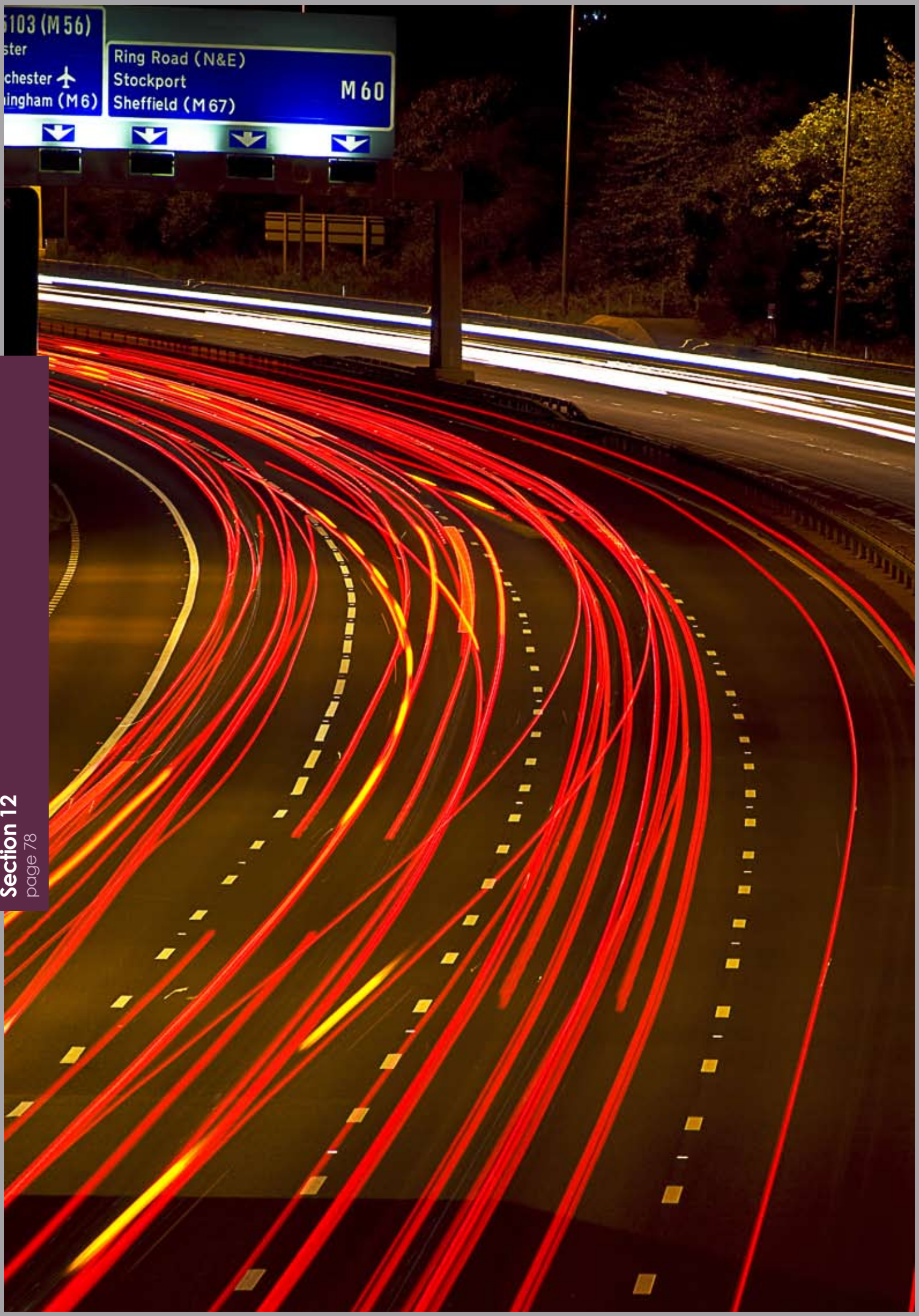
Enabling Action

Development of consistent planning policies that require all non-residential developments to be zero carbon by 2019.

Again, as for residential actions, this action should be pursued by continuing conversations over the development of consistent planning policies across GM, potentially through the development of a GM Energy Spatial Plan.

[56] *Although this project is aimed at focusing on residential retrofitting projects, it is possible that similar modelling could be produced to test technologies for commercial and service sector buildings.*

[57] *This could include systems which allow energy users or aggregators to manage the energy demand of a building, cutting off non essential operations during peak times (or times when the carbon intensity of the grid is high). This would allow renewable generation to be utilised more effectively.*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M60

Section 12
Demand Reduction Actions in the Industrial Sector

12.1 Introduction

The industrial sector generates 3% of GM's CO_2 emissions[58]. In contrast with the commercial and services sector, energy use within the industrial sector features a more even spread of fossil fuels and grid electricity. The extent to which fossil fuel use (and related CO_2 emissions) can be reduced is somewhat limited in the context of industry due to the proportion which is linked to direct heating and/or steam-raising for specific processes.

12.2 Potential National Actions

12.2.1 European Union Emission Trading Scheme and Carbon Reduction Commitment Energy Efficiency Scheme

The primary sources for GM emission savings in the industrial sector are likely to be alignment with the nationally managed Carbon Reduction Commitment (CRC) Energy Efficiency Scheme[59] and the European Union Emission Trading Scheme[60]. Adoption of these schemes is estimated to result in savings within the sector of up to 20% by 2020.

In terms of overall GM emissions, this would represent savings of up to 0.6% by 2020.

12.3 Potential GM Actions

Examples exist of industrial firms and sites achieving notable energy (and associated emission) savings via the introduction of automated night-time shutdown of non-essential or inoperative plants. However, the quantification of such savings becomes difficult without knowledge of companies' plant and operating philosophies so has not been included here.

12.4 What is Happening Already in GM?

There have been discussions in GM about using heat from industrial processes for district heat networks.

The Carbon Trust, Enworks and Envirolink provide a comprehensive package of support for CO_2 reduction and resource efficiency for SME's and larger companies, which can include businesses from the industrial sector.

[58] *Intelligent Energy Europe, AGMA and NWDA' with 'Carbon Captured and Manchester: Knowledge Capital'*

[59] *The CRC Energy Efficiency scheme (formally known as the Carbon Reduction Commitment) is the UK's mandatory energy saving scheme. Large organisations in the public and private sector will need to monitor their emissions and purchase 'allowances' for each tonne of CO_2 they emit, providing a financial incentive to reduce energy use.*

[60] *Under the EU ETS, large emitters of carbon dioxide within the EU must monitor and annually report their CO_2 emissions, and they are obliged every year to return an amount of emission allowances to the government that is equivalent to their CO_2 emissions in that year. This provides a financial incentive for large emitters to reduce emissions.*

12.5
Recommendations for Action

12.5.1 Gathering Information on GM's Industrial Emissions

Given the lack of information on actions in the industrial sector, the main action for this sector is around gathering information.

Enabling Action

Obtain further data on industrial emissions in GM.

This could be implemented by:

1) Baseline research with Envirolink and Enworks on where GM's industrial emissions come from;
2) Engaging with businesses to support them in planning for requirements introduced by the CRC Energy Efficiency Scheme and the EU Emissions Trading Scheme; and
3) Agree if any additional actions should be taken forward at the GM level to further reduce emissions from industry or assist GM businesses in reducing emissions to minimise costs imposed on emitters by national schemes.

12.5.2 Industry as a Source of Heat for District Heat Networks

Implementing this action would build on existing data on potential heat suppliers developed through the DES and subsequent LA studies, potentially using engagement with industry in the action above.

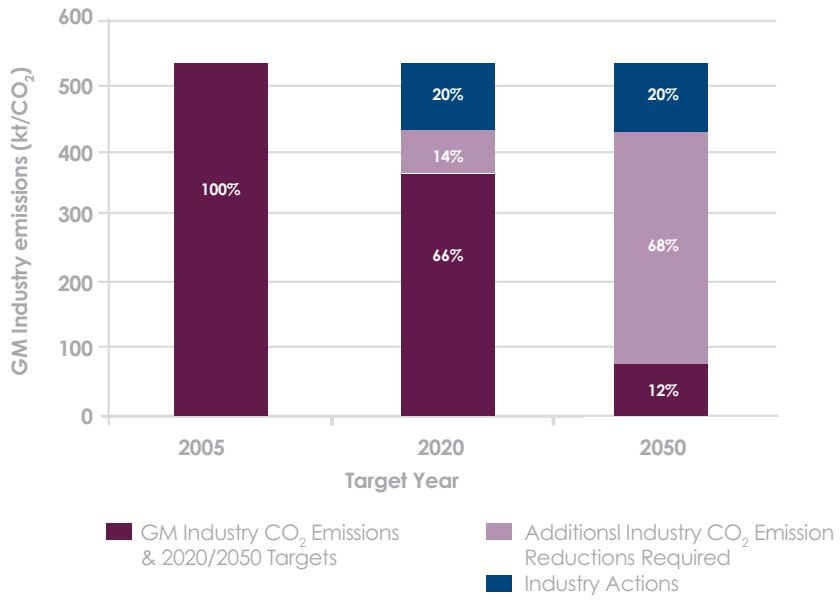

Figure 21: Industry Actions

Section 13
Comparison between Potential Actions and Targets

This SEAP report suggests that a minimum target for GM should be a 34% reduction in CO_2 emissions by 2020, compared to a baseline year of 2005. The SEAP report recommends that GM should select actions that would achieve more than a 34% reduction to ensure success in meeting this target. This is because it is highly likely that barriers (e.g. funding, influencing behavioural change and politics) will affect the success of some actions.

There are two major uncertainties in the quantification process. The first is whether the Government will succeed in a rapid decarbonisation of the National Grid. A slower or less successful decarbonisation of the grid than that suggested in the two scenarios would mean that GM needs to identify additional actions to meet the shortfall. Consequently, the conclusions are presented in two sections, each looking at a different grid decarbonisation scenario.

The second major uncertainty is the changes that will occur in the longer term, introducing significant uncertainties in predictions for reductions up to 2050. In particular, it is very difficult to predict the level of technological change that will occur over this period. However, other factors such as the demand for energy, social and cultural change, political structures, funding and finance available and so on will all have a large impact in the long term. Projections to 2050 should be interpreted in this uncertain context.

It should be noted that this SEAP report does not set targets for CO_2 reductions by sector and no analysis has been carried out comparing the cost effectiveness of different actions. Therefore, the section below should be used to indicate what the actions identified here may be able to achieve and should not be taken as indicating what targets should be for each sector.

13.1 Market Transformation Programme Decarbonisation of the Grid Scenario

Under the Market Transformation Programme (MTP) scenario, if all potential actions described in this SEAP report are implemented and result in the projected CO_2 emission reductions, GM would be on track to meet the target for a 34% reduction. However, there would still be a 7% shortfall compared to 2050 targets. This means that GM need to take firm and early action on all areas discussed in this SEAP report to meet its targets, and identify further actions to meet 2050 targets. Further, as this SEAP report focuses on priority actions for GM, the actions described would not deliver the total potential savings outlined in each section so further implementation actions would need to be developed over time to deliver the potential reductions.

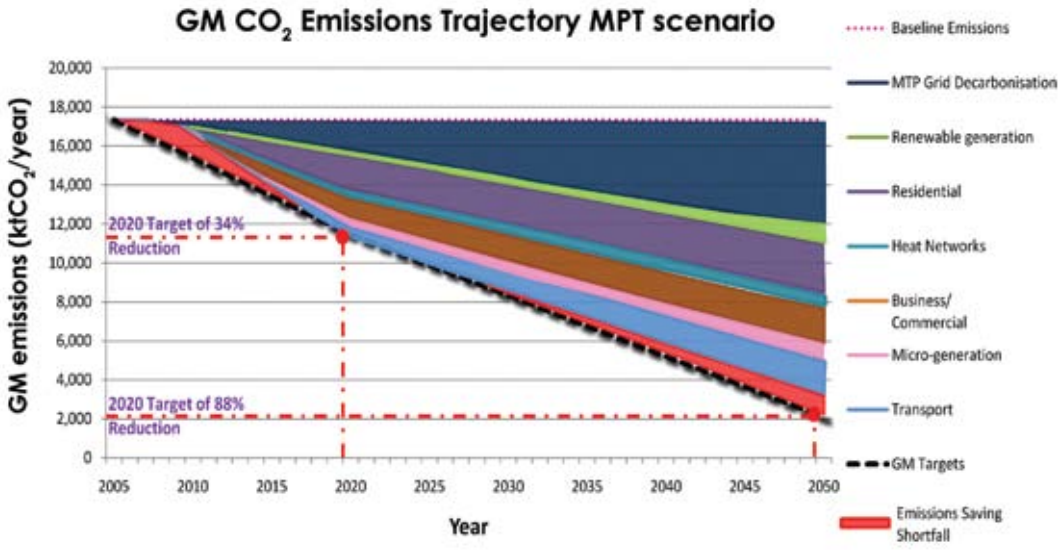

Figure 22: Market Transformation Programme Scenario and Potential GM CO_2 Reductions

Low Carbon Transition Plan

Under the Low Carbon Transition Plan scenario a significant amount of CO_2 emissions would be reduced through national actions, meaning that if all potential actions in the SEAP report were implemented and successful, GM would over-achieve its targets. The projections show that under this scenario, GM would reduce emissions by 48% by 2020 and 91% by 2050. However, this relies on the UK generating 40% of its electricity from renewable resources, with this very fast increase continuing until 2050. Again, further implementation actions will be required for GM to deliver potential reductions identified here.

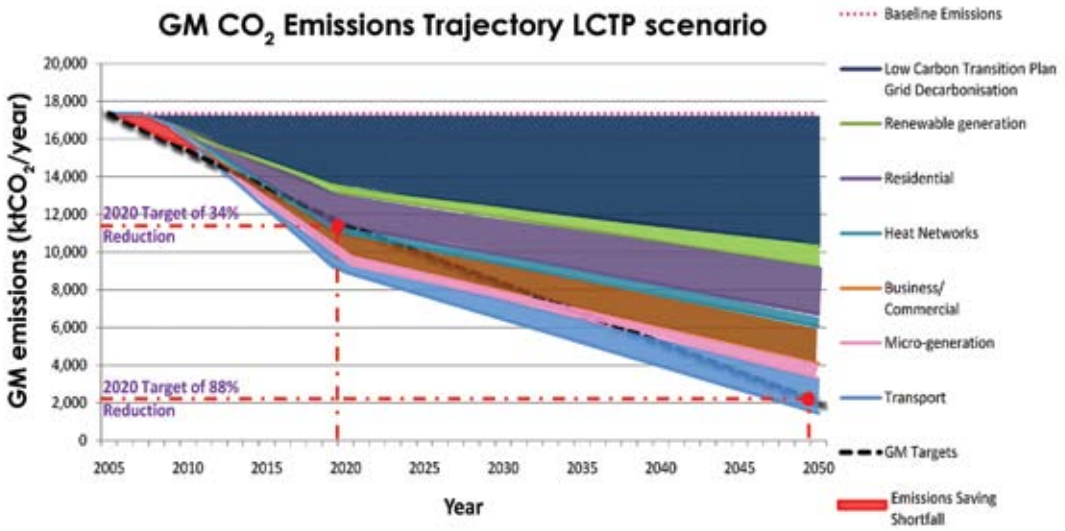

Figure 23: Low Carbon Transition Plan Scenario and GM Potential CO_2 Emission Reductions

Section 14
Monitoring and Updating the SEAP Report

14.1 Approach to Monitoring and Future SEAP Report Iterations

Consultation with stakeholders on the sustainable energy action planning process suggested that there should be two stages to updating the SEAP report, an annual monitoring of progress, and a full SEAP report iteration.

14.1.1 Monitoring Progress

The first stage should be annual monitoring of SEAP report progress examining:

- What actions have been taken forward;
- What actions are currently experiencing difficulties with implementation; and
- How GM is performing against its key performance indicators.

The annual monitoring should examine which actions have been implemented and been successful (e.g. how many houses have had cavity wall insulation installed). However, the process should not put undue burden on the implementing body to gather information. It is therefore suggested that 'actors' should be asked to provide information on their progress against actions on a yearly basis, but that there should be no necessity to research further information until the full SEAP report review. This will enable the organisation with ownership of the SEAP process to concentrate on actions that will reduce CO_2 emissions in between SEAP report iterations.

As discussed above, this monitoring should be communicated within GM to aid information sharing as well as being a tool to measure progress. Monitoring progress can also help provide evaluative information on interventions that can be used to:

- Publicise GM's successes to other cities in the UK and abroad and promote GM as a centre of excellence for CO_2 reductions;
- Provide a feedback loop so that organisations know the impacts of their programmes. This can be used to reward organisations who have done well through publicity or use of schemes as examples of best practice; and
- Inform and shape future interventions by highlighting the types of interventions that are, and are not successful.

14.1.2 SEAP Report Review

The second stage should be a SEAP report review. It is suggested that this review should be carried out every three years. This allows a sufficient period to enable strategic actions to be carried out and keeps the momentum on delivering the change required by issuing annual updates. The SEAP report review should examine:

- How the national, regional, sub-regional and local context has changed since the previous publication (including a review of the baseline);
- What actions have come forward at the national level to alter the targets GM have to meet as a sub-region;
- Whether the GM actions are correct in the changing context and the development of new actions for GM to support the delivery of a sustainable energy system;
- What lessons have been learnt from the evaluation of previous actions; and
- Whether targets and key performance indicators remain correct.

During full reviews, energy use and CO_2 emissions by sector should be re-examined to enable sectors to assess their own progress. This could be done during annual reviews if data is easily collected.

14.2 Key Performance Indicators (KPIs)

14.2.1 What Should the KPIs be for the SEAP Report?

The following Key Performance Indicators are proposed to monitor progress of the SEAP report:

1) Total CO_2 emissions in GM;
2) CO_2 emissions per capita;
3) Domestic CO_2 emissions per capita
4) CO_2 emissions per £ of Gross Value Added;
5) Electricity and heat generated in GM (GWh per annum) using:
   a) renewable sources (e.g. wind power); and
   b) low carbon sources (e.g. gas CHP plants); and
6) Percentage of energy generated in GM from all fuel sources.

14.2.2 How is GM Currently Performing Against these KPIs?

The following tables show how GM has been performing against the KPIs suggested above.

GM Actual	Annual CO_2 Emissions (kt)
2005	17,354.44
2006	17,132.10
2007	16,727.98

Table 2: Total Annual CO_2 emissions

GM Actual	Annual CO_2 Emissions - Tonnes per Capita
2005	6.82
2006	6.71
2007	6.53

Table 3: CO_2 Emissions Per Capita

GM Actual	Annual Domestic CO_2 Emissions - Tonnes per Capita
2005	2.41
2006	2.35
2007	2.31

Table 4: Domestic CO_2 Emissions per Capita

GM Actual	Annual CO_2 emissions per £ of GVA (t/£M)
2005	410.46
2006	405.20
2007	394.98

Table 5: CO_2 Emissions per £ of Gross Value Added

MWe of installed generation capacity in GM				
GM Actual	**Renewable MWe**	**EfW MWe**	**Fossil Fuels MWe**	**Total MWe**
2005	8.81	31.46	122.63	162.9

Table 6: MWe of Installed Energy Generation

Section 15
Next Steps

15.1
Introduction

The graphs in Chapter 13 place all actions on one baseline to enable consideration of whether actions will be sufficient to meet targets and which actions could have the largest impact on CO_2 emissions. The scale of the task to achieve these 'potential' savings should not be underestimated. Although theoretically possible to achieve, these actions would require significant, early action from GM to deliver. To illustrate the scale of the task, the table below provides some examples of what would need to be achieved to deliver the savings identified.

Sector	Component Action (% reduction in GM Emissions by 2020)	What would be needed to deliver this reduction by 2020
Supply: Macro	District heat networks (assuming use of biomass): 2%	Manchester Town Hall Cluster to deliver 14MW of capacity (7 electrical and 7 thermal). Delivery of half of the remaining Manchester City Centre heat network, 3 district heat networks in sub-regional centres and 8 in local centres.
Supply: Micro	Photovoltaics and solar thermal technologies on residential buildings: 1.5%	Assumes that 20% of houses in GM are suitable for these technologies and 50% of those suitable are installed by 2020 (i.e. 10% of houses in GM to have photovoltaics or solar thermal panels installed).
Demand: Residential	Loft insulation in residential buildings: 0.5%	Assumes 8% of homes have no loft insulation and 80% of these are provided with loft insulation by 2020.
Demand: Commercial/ Services	Energy efficient lighting	Assumes that 1.8% of electricity needs in commercial/service sector buildings can be saved using energy efficient lighting and that 50% of these reductions are achieved.
Demand: Electric cars	Driver efficiency	Assumes 5% of the GM population drive electric cars by 2020.

Table 6: Examples of Scale of Actions Required to Deliver Potential Actions

There will be some actions that can deliver early wins, or will need to be implemented to support the delivery of other actions. These have been identified as priority actions, which GM should focus on first to deliver a low carbon economy.

15.2
Delivering Priority Actions

A set of priority, short-term actions is presented overleaf with suggested actors for delivery. The actors are provided as suggestions only and it would be first job of a co-ordinating body to identify and obtain the buy-in necessary to advance the actions. However, to deliver the scale of reductions required to meet GM's targets, it is likely that all actions set out in Appendix A would need to be pursued and potentially supplemented by additional actions to ensure targets are met.

A1 Table Summarising Greater Manchester Actions

Enabling Action | Primary Action

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
General Enabling Actions							
Develop political and administrative structures to aid delivery of SEAP actions.	Co-ordinating body Joule Centre	Identify a body to co-ordinate SEAP actions. Identify an actor for each action in the GM SEAP and obtain buy-in. Publish annual SEAP monitoring information. Develop a communication strategy for SEAP information. Explore development of a single funding pot for delivery of SEAP actions and/or more control over future resources for GM with national government. Carry out a mapping exercise of existing expertise in public and private organsiations.	Establishment of GM Energy Group and the AGMA Commissions. The Joule Centre has completed work mapping energy expertise in GM Universities.	Short-term (1-6 months)	1	N/A	N/A
Agree on relationship between SEAP and LA documents and approaches.	LAs (supported by AGMA)	Agree how the SEAP report will support LA target setting. Use the above to ensure that a consistent approach is followed to setting targets across GM. Agree common metrics for measuring CO2 emissions across GM. Encourage LAs to explicitly set targets for 2020 using a 2005 baseline. Ensure that LA targets would cumulatively achieve GM targets. Consider if there would be merit in developing LA level SEAPs.	DES study and subsequent meetings with LAs. LA's own energy evidence base studies, National Indicator work, Core Strategy targets, Climate Change Action Plans etc.	Medium-term (1-12 months)	2	N/A	N/A
Develop an assessment approach to examine how actions can be implemented in a way that maximises the economic benefits of actions for GM	Co-ordinating body to identify actors	Develop an assessment approach examining how each action can be carried out in a way that maximises economic growth.	Existing research on maximising the opportunities for a low carbon economy in GM (e.g. Mini-Stern for Manchester).	Short-term (1-9 months)	1	N/A	N/A

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Develop and implement a robust approach to, and programme of, national government engagement aligned with key consultation opportunities and legislation development timelines.	Co-ordinating body	Put itself forward as a centre of learning and development in the field of Smart Grids. Ensure that LCEA work is captured during the suggested restructuring of support agencies. Identify and reflect the national changes to spatial planning frameworks. Advocate a strong and specific floor price for carbon, a substantial feed in tariff, strengthening, integration and early introduction of Renewable Obligation Certificates and incentive arrangements for both power and heat; and Introduce a requirements for all organisations generating waste heat to have identified and secured heat utilisation solutions.	AGMA city-region pilot provides opportunities to gain more resources for GM.	Medium-term (1-18 months)	1	N/A	N/A
Take forward the Sankey diagram methodology as a monitoring tool.	Co-ordinating body	Review the Sankey diagram during SEAP reviews. Consider extending the methodology to take account of new factors such as investment and cost flows.	Sankey diagram developed as part of this SEAP report.	Long-term (12-36 months)	3	N/A	N/A
Revisit the SEAP report methodology during the next SEAP report review and consider whether alternative or additional methods are appropriate for measuring CO_2 emissions in the changing context.	Co-ordinating body	Re-visit assumptions in the next SEAP report, including consideration of whether the next SEAP report should split targets by sector, consider aviation and shipping, incorporate embodied energy etc.	Sankey developed as part of the 2010 SEAP. Research on aviation has been completed by the Joule Centre. Manchester City Council have been looking at ways to consider embodied energy in target setting.	Long-term (12-36 months)	3	N/A	N/A
Develop a consistent approach to spatial energy planning across GM	LAs (supported by AGMA)	Consider developing a consistent approach to energy planning through development of an Energy Strategy, potentially including an Energy Spatial Plan.	Abolition of RSS could lead to increased need for statutory Energy Spatial Plan.	Medium Term (1-12 months)	3	N/A	N/A

Priority Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date
Education and information sharing on retrofitting commercial and service buildings with measures to reduce CO_2 emissions.	Co-ordinating body	• Identify best practice commercial retrofitting projects in and around GM. • Organise education workshops on commercial and public sector retrofitting. • Map expertise and networks in GM. • Supporting Envirolink's groups and providing them with contacts for further information or advice.	Some business and service sector organisations have been completing retrofits in GM. Joule Centre and Salford University have completed research on existing expertise in GM. Envirolink has set up small groups on specific issues such as LED lighting and smart meters.
Actions on funding and finance to include supporting commercial and public sector retrofitting projects.	Co-ordinating body	• Addressed through the general funding actions, but with an emphasis on addressing particular concerns of this sector. • Develop a database of information on funding for the commercial sector (e.g. CO_2 savings per £ for triple glazing) to support interventions.	Organisations have obtained funding for a large number of small schemes.
Identify industry partners who may be able to provide heat for district heat networks.	Co-ordinating body to identify delivery actor	• Build on existing data on potential heat suppliers developer through the DES and subsequent work on heat networks in GM.	

Section 16
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Appendix A

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Appendix A
Summary of Actions with Timescales and Actors

Table Summarising Greater Manchester Priority Actions

Enabling Action | Primary Action

Priority Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date
Develop political and administrative structures to aid delivery of SEAP actions.	Co-ordinating body	• Identify/develop a task and finish group to assist in gaining funding for GM SEAP actions. • Identify an actor for each action in the GM SEAP and obtain buy-in. • Publish annual SEAP monitoring information. • Develop a communication strategy for SEAP information. • Explore development of a single funding pot for delivery of SEAP actions and/or more control over future resources for GM with national government. • Carry out a mapping exercise of existing expertise in public and private organisations.	Establishment of GM Energy Group and the AGMA Commissions. The Joule Centre has completed work mapping energy expertise in GM Universities.
Develop an assessment approach to examine how actions can be implemented in a way that maximises the economic benefits of actions for GM.	Co-ordinating body to identify actors	• Develop an assessment approach examining how each action can be carried out in a way that maximises economic growth.	Existing research on maximising the opportunities for a low carbon economy in GM (e.g. Mini-Stern for Manchester).
Investigate ways to support renewable and low carbon energy developments that currently have difficulty obtaining planning permission.	LAs (supported by AGMA)	• Investigate how renewable energy developments can be supported in planning. • Discuss how to speed up application process with national government. • Education for communities on pros and cons of technologies.	Significant body of work completed as part of the DES and LA's evidence base studies. Many LAs have completed projects around community education and engagement.
Develop support mechanisms to enable actors to obtain funding for SEAP actions.	Co-ordinating body Energy Group funding task and finish group	• Identify/develop a task and finish group to assist in gaining funding for GM SEAP actions. • Engage with national government to gain more control over funding for GM. • Collate information about existing and future funding streams. • Support organisations on funding applications. • Utilise existing research to determine whether planning can secure funding for energy actions.	Existing expertise in gaining funding for GM spread across organisations (e.g. Manchester: Knowledge Capital). DES and LA studies on role planning can have in securing funding for energy projects. M:KC report on ESCos.
Support research and development of Smart Grids in GM.	GM Energy Group, ENW and Corridor Manchester	• Bring together existing and emerging research on Smart Grids in GM. • Establish a working group of actors to develop a coherent approach to Smart Grid development and deployment for GM. • Support development of a Smart Grid pilot in GM and work programme for implementation. • Engage with Electricity North West on benefits and potential locations for Smart Grids.	Existing research on smart grids in GM. ENW considering bidding for funding for a smart grid pilot in GM.
Support the development of district heat networks in GM where they are viable and would reduce GM's CO_2 emissions.	Co-ordinating body to identify delivery actors LAs (with support from Co-ordinating body)	• Develop a consistent, detailed GM heat map. • Define what constitutes an 'opportunity' for a heat network in each LA area. • Encourage information sharing on heat networks throughout GM (particularly the Manchester Corridor). • Identify potential heat customers for Carrington Power Station and identify additional sources of heat that can meet the heat demand. • Utilising information on potential heat suppliers (existing or developed through the GM heat map).	High level heat mapping has been completed across GM as part of the DES, with more detailed heat mapping completed in some areas through LA studies and project-specific feasibility work (e.g. Manchester Town Hall Cluster).

Priority Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date
Support development of Energy from Waste (EfW) plants to generate electricity and heat in commercial, service and industrial sectors	Co-ordinating body to identify delivery actors	• Identify priority EfW projects in GM. • Engage with waste professionals to agree a strategy to bring forward priority projects. • Ensure when EfW plants are specified, they need to consider opportunities for heat networks.	Research has been completed on EfW plant potential in GM.
Promote funding and finance benefits of micro-generation.	LCEA (and other actors dealing with businesses and residents in GM)	• Promotion of Feed-in-Tariffs (FiTs and the Renewable Heat Incentive (RHI). • Provision of clear information about the financial costs and benefits of micro-generation schemes. • Consider conducting research on the impact of micro-generation on house re-sale prices.	Some LAs are considering / have developed micro-generation areas and are publicising RHI and FiTs in these areas.
Encourage development of local supply chains for micro-generation technologies.	Envirolink/Enworks	• Partnership between Envirolink Northwest and Enworks to promote lists of businesses. • Consider development of a resource to help people locate a supplier and installer of micro-generation technologies. • Identify gaps in current supply chains and determine a way to address issues.	Envirolink and Enworks are carrying out various actions to support local businesses that could supply and install micro-generation technologies.
Develop and implement area based micro-generation schemes in three areas of GM.	LAs and/or LCEA	• Identify three areas that might be suitable for micro-generation technologies. • Review the types of technologies that could be used in that area and ensure there are suppliers who could meet the demand. • Develop a communication strategy to promote micro-generation in identified areas. • Develop partnership mechanisms for delivering the scheme.	Existing work through the DES and subsequent LA studies.
Engage and build partnerships with transport stakeholders in GM	Co-ordinating body to identify delivery actor	• Engaging and building partnerships with transport stakeholders in GM to develop a CO_2 reduction strategy for transport.	AGMA Transport Commission and partnership building through organisations such as the GM Energy Group.
Encourage and support use of electric, hybrid and ultra-low emission vehicles.	Co-ordinating body to identify delivery actor	• Submission of a successful Plugged-in Places bid. • Learn from experience in other areas to understand the most effective ways to implement charging infrastructure. • Encourage integration of charging points into key locations around GM. • Consider GM planning requirements for charging points in new developments. • Engage with ENW to discuss the relationship between the existing grid and a potential future changes to electricity demand.	Previous Plugged-in-Places bid. GM actions to purchase and integrate hybrid bus services. Consideration of planning requirements for charging points in GM and LA studies.
Comprehensive roll-out of programme to retrofit domestic buildings with technical solutions that will reduce heat and electricity demand.	LCEA	• Development of a business plan as part of the LCEA programme. • Establishment of a funding and financing model for delivery of LCEA programme. • Development of supply chains for materials to implement LCEA programme. • Delivery of the support packages for property owners. • Programme to promote the package across GM. • Set whole house standards as part of consents for building modifications. • Incorporate measures to evaluate the success of LCEA interventions in reducing CO_2 emissions in GM. • Consider whether residents can also be targeted with information about sustainable transport choices alongside residential actions.	LCEA programme is being developed at the moment and should lead on taking forward these actions.

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Investigate ways to support renewable and low carbon energy developments that currently have difficulty obtaining planning permission	LAs (supported by AGMA)	Investigate how renewable energy developments can be supported in planning (e.g. identifying areas in the Energy Strategy above). Discuss how to speed up application process with national government. Education for communities and key stakeholders (e.g. Council members) on pros and cons of technologies.	Significant body of work completed as part of the DES and LA's evidence base studies. Many LAs have completed projects around community education and engagement.	Short-term (1-6 months)	1	N/A	N/A
Develop support mechanisms to enable actors to obtain funding for SEAP actions.	Co-ordinating body Energy Group funding task and finish group	Identify/ develop a task and finish group to assist in gaining funding for GM SEAP actions. Engage with national government to gain more control over funding for GM. Collate information about existing and future funding streams. Support organisations on funding applications. Utilise existing research to determine whether planning can secure funding for energy actions.	Existing expertise in gaining funding for GM spread across organisations (e.g. Manchester: Knowledge Capital)". DES and LA studies on role planning can have in securing funding for energy projects. MKC report on ESCos.	Short-term (1-6 months)	1	N/A	N/A
Support research and innovation in both universities and businesses in GM.	Co-ordinating body with university partners	Organise a meeting with potential university partners to identify areas where research could be developed to reduce CO_2 emissions in GM and support economic growth.	Wealth of research in universities and some partnership working between businesses and universities in GM.	Short-term (1-6 months, although benefits are likely to be felt in the very long-term).	2	N/A	N/A
Support research and development of Smart Grids in GM.	GM Energy Group, ENW and Corridor Manchester	Bring together existing and emerging research on Smart Grids in GM. Establish a working group of actors to develop a coherent approach to Smart Grid development and deployment for GM. Support development of a Smart Grid pilot in GM and work programme for implementation. Engage with Electricity North West on benefits and potential locations for Smart Grids.	Existing research on smart grids in GM. ENW considering bidding for funding for a smart grid pilot in GM.	Short-term (1-6 months)	1	N/A	N/A

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Supply 1: Macro Renewable and Low Carbon Energy Actions							
Support the development of district heat networks in GM where they are viable and would reduce GM's CO_2 emissions.	Co-ordinating body to identify delivery actors LAs (with support from Co-ordinating body)	Develop a consistent, detailed GM heat map. Define what constitutes an 'opportunity' for a heat network in each LA area. Encourage information sharing on heat networks throughout GM (particularly the Manchester Corridor). Identify potential heat customers for Carrington power station and identify additional sources of heat that can meet the heat demand. Utilising information on potential heat suppliers (existing or developed through the GM heat map).	High level heat mapping has been completed across GM as part of the DES, with more detailed heat mapping completed in some areas through LA studies and project-specific feasibility work (e.g. Manchester Town Hall Cluster).	Short-term (1-6 months)	1	0.7 - 2.1% (0.7% is based on the use of a natural gas-fired CHP, used because EfW and biomass are considered below. Report graphs use gas to avoid double counting. The potential is far higher if biomass and/or EfW is used, i.e. 2.1%).	1.5 – 3.8% (Range derived as for 2020.)
Support development of Energy from Waste (EfW) plants to generate electricity and heat in commercial, service and industrial sectors	Co-ordinating body to identify delivery actors	Identify priority EfW projects in GM. Engage with waste professionals to agree a strategy to bring forward priority projects. Ensure when EfW plants are specific, they need to consider opportunities for heat networks.	Research has been completed on EfW plant potential in GM.	Short-term (1-6 months)	1	0.5%	2.2%
Facilitate the development of community level renewable energy schemes in GM.	Co-ordinating body to identify delivery actors	Encourage LAs to share information on community scale schemes to facilitate other schemes. Use future central GM structure and resources to support future schemes if feasible.	Stockport have carried out feasibility work on potential hydro power schemes.	Short-term (1-6 months)	3	Unknown, hydropower could be > 0.02%	Unknown, hydropower could be > 0.04%
Engage with Universities to explore opportunities for new and innovative renewable and low carbon energy technologies.	Joule Centre	Working with Universities to capture new research in SEAP annual updates, looking at new and emerging technologies such as capturing energy from transport.	Wealth of innovative research being carried out in GM universities. Low Carbon Laboratory could provide a test-bed for new technologies and ideas.	Long-term (12-36 months)	3	N/A	N/A

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Supply 2: Micro-Generation Actions							
Promote funding and finance benefits of micro-generation.	LCEA (and other actors dealing with businesses and residents in GM)	Promotion of Feed-in-Tariffs and the Renewable Heat Incentive. Provision of clear information about the financial costs and benefits of micro-generation schemes. Consider conducting research on the impact of micro-generation on house re-sale prices.	Some LAs are considering/ have developed micro-generation areas and are publicising RHI and FiTs in these areas.	Short-term (1-6 months)	1	N/A	N/A
Encourage development of local supply chains for micro-generation technologies.	Envirolink/Enworks	Partnership between Envirolink Northwest and Enworks to promote lists of businesses. Consider development of a resource to help people locate a supplier and installer of micro-generation technologies. Identify gaps in current supply chains and determine a way to address issues.	Envirolink and Enworks are carrying out various actions to support local businesses who could supply and install micro-generation technologies.	Short-term (1-12 months)	1	N/A	N/A
Develop and implement area based micro-generation schemes in three areas of GM.	LAs and/or LCEA	Identify three areas that might be suitable for micro-generation technologies. Review the types of technologies that could be used in that area and ensure there are suppliers who could meet the demand. Develop a communication strategy to promote micro-generation in identified areas Develop partnership mechanisms for delivering the scheme.	Existing work through the DES and subsequent LA studies	Short-term (1-12 months)	1	Micro-Combined Heat and Power: 0.6% Photovoltaics: 1.1% Solar thermal: 0.6% Total: 2.3%	Micro-Combined Heat and Power: 1.3% Photovoltaics: 2.1% Solar thermal: 1.3% Total: 4.7%

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Transport Actions							
Engage and build partnerships with transport stakeholders in GM	Co-ordinating body to identify delivery actor	Engaging and building partnerships with transport stakeholders in GM to develop a CO_2 reduction strategy for transport.	AGMA Transport Commission and partnership building through organisations such as the GM Energy Group.	Short-term (1-6 months)	1	N/A	N/A
Encourage and support use of electric, hybrid and ultra-low emission vehicles.	Co-ordinating body to identify delivery actor	Submission of a successful Plugged-in Places bid. Learn from experience in other areas to understand the most effective ways to implement charging infrastructure. Encourage integration of charging points into key locations around GM. Consider GM planning requirements for charging points in new developments. Engage with ENW to discuss the relationship between the existing grid and a potential future changes to electricity demand.	Previous Plugged-in-Places bid. GM actions to purchase and integrate hybrid bus services. Consideration of planning requirements for charging points in GM and LA studies.	Short-term (1-6 months, although integration is more realistic in medium to long-term)	1	0.4%	3.7%
Increasing use of alternative (non-electric) fuels in vehicles.	Co-ordinating body to identify delivery actor	Engagement with transport stakeholders on potential research in this area and discussion on potential interventions.		Short-term (1-6 months)	2		
Encourage people to make smarter travel choices.	LAs	Define groups who will be targeted with programmes to change their travel behaviour. Develop a programme of intervention. Using research to inform other improvements to public transport and/or walking and cycling infrastructure. Evaluate implementation and the impact interventions have had on behaviour.	GMPTE and LAs, with other transport stakeholders have been carrying out work in this area.	Medium-term (6-18 months as will need to be supported by other actions)	1	0.5%	2.4%

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Encourage car drivers to maintain vehicles and drive more efficiently.	Co-ordinating body to identify delivery actor	Development of a programme to promote vehicle maintenance and efficient driving.	GM is using the Government's Green Bus Fund to incorporate an Eco-Drive system in new vehicles which encourages optimal driver behaviour.	Medium-term (6-18 months)	3	Driver efficiency for personal transport: 0.3% Maintenance of existing vehicles: 0.3% Total: 0.6%	Driver efficiency for personal transport: 0.5% Maintenance of existing vehicles: 1% Total: 1.5%
Measures to further support increases to mode capacity and develop smart transport solutions for public transport	Co-ordinating body and GMPTE	Engagement with transport operators and other stakeholders to identify opportunities and barriers to public transport upgrades. Consideration of method to enable collection of data on transport choices to inform future changes to mode capacities, route changes and upgrades (smart transport).	Significant work underway to upgrade and expand the Metrolink network in GM. Digital ticketing programme currently being developed by GMPTE and partners.	Short-term (1-6 months)	2	0.1%	0.4%
Reduce distance travelled	Co-ordinating body to identify delivery actor	Potentially develop integrated travel plans. Encourage travel planning by businesses located in GM to investigate potential CO_2 reductions. Consider whether measures to reduce distance travelled can be promoted alongside residential actions below.	LAs have been encouraging and requiring travel plans from new developments for some time. Businesses and public sector organisations have developed successful travel plans.	Medium-term (6-18 months)	2	0.7%	1.1%

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Residential Sector							
Comprehensive roll-out of programme to retrofit domestic buildings with technical solutions that will reduce heat and electricity demand.	LCEA	Development of a business plan as part of the LCEA programme. Establishment of a funding and financing model for delivery of LCEA programme. Development of supply chains for materials to implement LCEA programme. Delivery of the support packages for property owners. Programme to promote the package across GM. Set whole house standards as part of consents for building modifications. Incorporate measures to evaluate the success of LCEA interventions in reducing CO2 emissions in GM. Consider whether residents can also be targeted with information about sustainable transport choices alongside residential actions.	LCEA programme is being developed at the moment and should lead on taking forward these actions.	Short-term (1-6 months, with medium to long-term delivery)	1	Insulation Improvements: 3.7%. Low-Energy Lighting: 0.3% Draught Proofing: 0.4%. Replacement of old Boiler Plant: 1.6% Double-Glazing Installation: 1.1% Total: 7.1%	Insulation Improvements: 4.6% Low-Energy Lighting: 0.4% Draught Proofing: 0.5% Replacement of old Boiler Plant: 2.7% Double-Glazing Installation: 2.7% Total: 10.9%
Encourage behavioural change that will reduce demand for electricity and gas in domestic properties in GM.	LCEA	Provision of smart meters to provide information to householders on energy use. Education programme in schools about reducing electricity and gas use. Community advertising campaigns around energy and gas use.	LCEA programme is being developed at the moment and should lead on taking forward these actions.	Medium-term (1-18 months)	1	3.1%	3.9%
Encourage development of consistent planning policies that require all residential developments to be zero carbon by 2016.	LAs (supported by AGMA)	Continuing discussions on the establishment of an Energy Spatial Plan that could recommend consistent approaches to new developments. How to support the skills and knowledge development required to enable developers in GM to meet higher energy efficiency standards for domestic buildings.	DES and LA studies. Core Strategies.	Medium-term (6-18 months, although adoption would be long-term)	3	Some reductions were considered as part of national actions chapter on building regulations	Some reductions were considered as part of national actions chapter on building regulations

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Commercial and Service Sector							
Education and information sharing on retrofitting commercial and service buildings with measures to reduce CO_2 emissions	Co-ordinating body	Identify best practice commercial retrofitting projects in and around GM. Organise education workshops on commercial and public sector retrofitting. Map expertise and networks in GM Supporting Envirolink's groups and providing them with contacts for further information or advice.	Some business and service sector organisations have been completing retrofits in GM. Joule Centre and Salford University have completed research on existing expertise in GM. Envirolink has set up small groups on specific issues such as LED lighting and smart meters.	Short-term (1-9 months)	1	N/A	N/A
Actions on funding and finance to include supporting commercial and public sector retrofitting projects.	Co-ordinating body	Addressed through the general funding actions, but with an emphasis on addressing particular concerns of this sector. Develop a database of information on funding for the commercial sector (e.g. CO_2 savings per £ for triple glazing) to support interventions.	Organisations have obtained funding for a large number of small schemes.	Short-term (1-9 months)	1	N/A	N/A
Encourage behavioural change to reduce energy use in commercial and service sector buildings.	Co-ordinating body to identify actors	Development and implementation of a programme to encourage reduce energy use in commercial and service sector buildings. Encourage uptake of Environmental Management Systems incorporating behavioural change actions.	Many businesses in GM have adopted Environmental Management Systems and are developing actions, through these, to reduce energy use from their activities and buildings.	Medium-term	1	1.9%	2.4%
Implement demonstration commercial and service sector projects in GM.	Co-ordinating body to identify delivery actor	Develop partnership with Universities through the Low Carbon Laboratory. Identify potential demonstration projects with willing partners. Identify funding and finance for demonstration projects. Deliver demonstration projects and publicise them as case studies.		Short-term (1-9 months, with delivery in long-term)	1	Figures were developed for the roll-out of commercial retrofitting actions rather than demonstration projects.	Figures were developed for the roll-out of commercial retrofitting actions rather than demonstration projects.
Development of consistent planning policies that require all non-residential developments to be zero carbon by 2019.	LAs (supported by AGMA)	Continuing conversations over development of consistent planning policies across GM, potentially through the development of a GM Energy Spatial Plan.	DES and LA studies. Core Strategies.	Medium-term (1-18 months, adoption may take more time)	3	Some reductions were considered as part of national actions chapter on building regulations	Some reductions were considered as part of national actions chapter on building regulations

Action	Suggested Lead Organisation	Steps to Facilitate Action	Progress to Date	Anticipated Time Scale (period)	Priority (1-3)	Potential Impact on GM Emissions (2020)[1]	Potential Impact on GM Emissions (2050)
Roll out commercial and service sector retrofitting programme.	LCEA	This action would draw upon experience from the demonstration projects above to develop a more comprehensive retrofitting programme.		Medium-term (1-18 months, to continue beyond 18 months)	1	Energy Efficient Lighting: 0.4% Modify Building Heating Set Points: 1.2% Night-Time Cooling: 0.3% Time Switches on Small Equipment: 0.2% Total: 2.1%	Energy Efficient Lighting: 0.7% Modify Building Heating Set Points: 2.4% Night-Time Cooling: 0.7% Time Switches on Small Equipment: 0.3% Total: 4.1%
Industrial Sector							
Obtain further data on industrial emissions in GM.	Co-ordinating body to identify delivery actor	Carry out baseline research with Envirolink and Enworks on where GM's industrial emissions come from. Engage with businesses on how they plan requirements for the Carbon Reduction Commitment and EU Emissions Trading Scheme. Agree if any additional actions should be taken forward at the GM level.	Some work on industrial emissions as been carried out as part of the baseline for the SEAP.	Medium-term (12-18 months)	3	N/A	N/A
Identify industry partners who may be able to provide heat for district heat networks.	Co-ordinating body to identify delivery actor	Build on existing data on potential heat suppliers developer through the DES and subsequent work on heat networks in GM.		Short-term (1-9 months)	1	Reductions are assumed to contribute to potential reductions delivered through heat networks.	Reductions are assumed to contribute to potential reductions delivered through heat networks.

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Appendix B
Methodology for GMFM CO_2 Projections

Greater Manchester Forecasting Model CO_2 Module (GMFM)

The GMFM and the CO_2 module has been produced by Oxford Economics on behalf of the Association of Greater Manchester Authorities (AGMA). It is worth stressing at the outset that, the CO_2 module for GMFM cannot hope to provide a complete analysis of the issues underlying the city-region's CO_2 impact on the environment. Rather, it provides an opportunity to estimate the impact of new economic forecasts and alternative scenarios on the expected scale of Greater Manchester (GM) contribution to CO_2 emissions, in order to inform other work on environmental policy. Oxford Economics are talking about a module attached to an economic, demographic and housing model in order to calculate CO_2 outputs, rather than a full-scale environmental model. So, for example, it is not at the stage planning to produce alternative scenarios based around alternative environmental policies, but rather to be able to produce estimates of CO_2 outputs associated with alternative economic scenarios.

Outputs

Geography – as with other model outputs, produces estimates for each LA within Greater Manchester, as well as for the city as a whole. The key units are kilo tonnes of CO_2 for each district.

Methodology – general

In a way, the underlying methodology for estimating CO_2 factors is relatively straightforward in concept:

- What are the key sources of energy demand and CO_2 emissions?
- What are we expecting to happen to the scale of the activity giving rise to the energy demand & CO_2 emissions?
- What are the appropriate coefficients for estimating the scale of energy demand & CO_2 emissions for a given scale of activity?
- What is likely to be the trend of this relationship over the future?

Suitable metrics and scaling factors have been derived, and have been applied to the existing district outputs of the GMFM such as population, the number of households and GVA by industrial sector to estimate overall CO_2 emissions for each district and GM as a whole. But the key aspect to this approach is correctly estimating such metrics and factors.

This note includes proposed assumptions in a number of areas and also mentions potential limitations Oxford Economics can envisage. On a broad level, one possible complication is that a number of metrics and estimates have to be calculated and derived from national data, in the absence of applicable regional statistics. This introduces the possibility of some systemic bias when scaling down to the GM region alone. However, even with the possibility of a small level of bias, with the same metrics being applied to each district in GM, the model outputs will rank together, highlighting the districts of GM that have the highest CO_2 emissions.

Methodology – estimating carbon dioxide emissions

To estimate CO_2 emissions Oxford Economics have used national statistics from DEFRA Local & Regional CO_2 Emissions Estimates 2005, '06 & '07 to backcast and forecast CO_2 emissions. However the figures used currently are from the first release of the statistics that have been recently revised (see table below). The Commission for the New Economy (CfNE) is aware of this fact and further revisions of the GMFM will update this anomaly.

DEFRA L&R CO_2 Emissions (kt) Original	DEFRA L&R CO_2 Emissions (kt) Revised
21,054	18,019
21,123	18,087
20,967	17,511

The GMFM also considers inputs from national statistics on energy demand from households, industry & commerce and transport, available from The Department for Energy and Climate Change. Oxford Economics approach has been to model energy demand following the following steps:

- The relationship between energy demand (split between electricity, gas and other) and the key drivers of demand in each sector (e.g. the price of energy, sectoral output or employment, household incomes or whatever) is estimated at the national level using historical data for the UK.
- The equations are calibrated to the Greater Manchester area at a district level by taking account of each area/district's share of UK output, employment or income for the relevant part of the economy, together with what Oxford Economics can deduce from the available historical information about the extent to which both domestic and non-domestic energy demand differ in the area/district from what would be suggested by the equations.
- The equations for energy demand are applied to the data and forecasts for the Greater Manchester area, taking account of the calibration of the equations to the specifics of the districts.
- Finally, any allowance for changes in trends (to capture efficiency trends for example), or policy impacts is added to (or subtracted from) the resulting forecasts.

However, as previously stated, such an approach makes it imperative to employ a coherent and sensible approach to forecast energy usage (and thus ultimately carbon dioxide emissions) at the UK level. Suggestions as to the key sensitivities between the key drivers of demand in each sector and energy demand are given below:

Households

Not surprisingly, the future number of households in the UK is likely to have a significant impact on overall household energy demand, with an energy demand elasticity of close to unity with respect to the number of households. Total energy demand will also depend on household income growth (represented by GVA growth) which tends to have a positive impact on household energy demand. Elasticities of demand with respect to energy prices are typically fairly low for households.

Transport

Transport demand for energy is typically modelled mainly as a function of GDP. Household transport tends to be negatively affected by the price of energy, but commercial transport demand is relatively price inelastic.

Industry

Overall industry energy demand will be positively driven mainly by output, with different estimates of the relevant sector elasticities being applied where applicable. A standard negative relationship between industry energy demand and energy prices would also be assumed. (Note that the electricity generation industry itself would not be included here since the demand for electricity is covered in other parts of the analysis).

In all these areas, the most difficult assumptions may be around how usage is expected to change over the future for given levels of activity (for example as a result of government policies to encourage greater efficiencies) rather than around current levels of usage for given levels of activity. It is for this reason that the GMFM is modelled as "policy off" until better modelling systems have been developed. Oxford Economics and CfNE are appraising this approach and will be developing the model overtime.

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