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AGMA
ASSOCIATION OF GREATER MANCHESTER AUTHORITIES

Developing Future Energy Scenarios for Greater Manchester

March 2010

Northwest
REGIONAL DEVELOPMENT AGENCY

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Intelligent Energy Europe

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Foreword

I welcome this report as a robust contribution to our collective understanding of the challenges we face as we work to develop a robust city-regional approach to the challenges of: maintaining security of energy supply, reducing CO_2 emission and maximising local economic advantage.

The report aims to stimulate new thinking of how we might develop pathways for delivering a low-carbon Greater Manchester, whilst securing the energy needed to meet our growth aspirations.

The stark reality of our current energy profile challenges us to examine closely our existing policies and plans and how far these go towards meeting our contribution to national CO_2 reduction and energy generation targets.

The process of developing these future energy scenarios involved over twenty of our local and regional partners from the public, private and NGO sectors. This co-creation of future low-carbon pathways is essential if we are to develop a genuine partnership approach to meeting the energy challenge.

This report is a welcome contribution to Greater Manchester's new cross-sector Energy Group, who will oversee the development of a sustainable energy action plan for the city-region during 2010. Greater Manchester's recent designation as a Low Carbon Economic Area for the Built Environment presents us with a tangible opportunity to fast-track investment in our energy infrastructure, accelerating the refurbishment of our energy inefficient buildings.

Combined with new national energy policy initiatives such as the Carbon Reduction Commitment and the Feed-in Tariff for renewable energy generation, Greater Manchester is well positioned to become a leading city-region in the progression towards a low-carbon future.

Councillor Mark Alcock
Chair, Greater Manchester Energy Group
Greater Manchester Environment Commission


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Introduction

Targeting Energy

In the UK, approximately 98% of our CO_2 emissions emanate from the burning of fossil fuels to meet our energy needs. Therefore the problems associated with mitigating the effects of climate change are essentially those associated with the way we currently generate, supply and use energy.

To effectively manage the reduction of CO_2 emissions, it is important to understand our energy system in terms of the fuels used for heating, cooling, power generation, transport and industrial processes.

The Greenhouse Gas Inventory Protocol's (GRIP) scenario process enables a range of stakeholders to participate in developing a set of energy scenarios for 2050. This process facilitates the participants to design a future low carbon energy system.

This report forms an important element of the social learning needed to gain common understanding of the challenges of reshaping our energy system to meet carbon reduction targets and growth aspirations. The process of scenario development outlined in the report, has identified some key learning points and priority actions likely to be required to achieve national CO_2 reduction targets.

Headlines from the Greater Manchester Scenario Workshops

- CO_2 reduction scenarios for 2050 of 87-90% were achieved, with economic growth of 2.00-2.25% per annum, whilst maintaining aviation emissions at 2005 levels
- The two scenarios that achieved a 90% reduction in CO_2 emissions reduced end-user energy consumption by between 40-46%
- Early action is required to ensure total emissions released are kept within national targets (budgets).
- Reductions across domestic, commercial and industrial, and transport sectors are best achieved with concerted interventions at city regional, national and EU levels

The three scenarios featured in this report were generated in workshops facilitated by Carbon Captured Ltd and Manchester: Knowledge Capital during October and November 2009. This work has been made possible by resources secured by Manchester: Knowledge Capital from the European Commission's Intelligent Energy in Europe Programme (PEPESEC Project) and the Northwest Development Agency.

Simon Robinson
Programme Manager
Manchester is my Planet

Shaping Greater Manchester's Energy Priorities

Over the last year the Association of Greater Manchester Authorities (AGMA) has put in place new governance arrangements to co-ordinate this process. In May 2009, the Greater Manchester Environment Commission was formed to co-ordinate the delivery of strategic environmental plans and projects. This was complemented in February 2010 with the launch of a new cross-sector Energy Group, charged with developing a strategic response to the challenge of reshaping our energy system. This report will feed the development of a Sustainable Energy Action Plan (SEAP) or 'energy plan' for Greater Manchester under the EU PEPESEC project. In addition the Environment Commission is developing a complementary low-carbon monitoring and performance framework. The aim of the SEAP is to provide city leaders and managers with the coherent, evidence-based and prioritised action plans needed to shape a more resilient energy system, better able to meet and manage our demands for heating, electricity and transport with fewer emissions and reduced environmental impacts.

The building blocks of the Sustainable Energy Action Plan for Greater Manchester

Political Endorsement	May 09
Baseline Research and Analysis	July 09 – Feb 10
Development of Future Energy Scenarios	Oct/Nov 09
Identification of Energy Actions	Nov 09 – April 10
Partner and Citizen Consultation	May 10
Draft Sustainable Energy Action Plan	June 10

The development of the SEAP for Greater Manchester will present the Energy Group with an opportunity for further development and embedding of sustainable energy management within the businesses processes of partner organisations.

Building on Progress

Over recent years the UK has put in place a wide range of policies and programmes aimed at shaping a low-carbon economy, culminating in the formation of Department of Energy and Climate Change (DECC) and passing of the Climate Change Act in 2008. These policies are being matched in Greater Manchester with the development of programmes and projects that are delivering carbon savings that contribute towards national targets.

These programmes and projects include the following:

Greater Manchester: A Low Carbon Economic Area for the Built Environment

This new designation for Greater Manchester 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 the city region and save up to 6 million tones of CO_2.

Delivering savings in the Domestic Sector

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 microgeneration. Lifetime savings from the EST's 2009-10 programme are estimated at 12,350 tonnes of CO_2.

Delivering savings in the Commercial and Industrial Sector

A variety of organisations provide support to Greater Manchester ambitions to reduce its emissions. These include, among others, the Carbon Trust, Enworks and Envirolink. This support is provided to Government departments, SME's and larger companies. For example in the last two years Enworks has delivered CO_2 savings totalling 83,176 tonnes in Greater Manchester through projects and initiatives that it has led or supported.

Supporting low-carbon transport

Extension to the Metrolink system, new hybrid buses, driver training programmes and improvements for cyclists and pedestrians are promising a steady improvement in meeting goals for a low-carbon transport system. Combined with new legislation to improve the efficiency of the UK's vehicles we can look to future where CO_2 emissions from transport start to reduce.

Low-carbon electricity generation and decentralised energy production

New developments including Scout Moor wind farm, community hydro schemes in Stockport and waste-to-energy plants have kick-started the harnessing of renewable energy sources in the city region. Combined with new planning frameworks, Greater Manchester is gearing up to capitalise on the opportunities, for reducing emissions, presented by decentralised and renewable energy generation

Whilst progress is being made across all sectors, this report highlights the importance of accelerating the rate of change to our energy system if we are to meet targets for 2020 and 2050.

The Need to Limit Global Emissions

There is now unequivocal evidence to show that warming of the climate system is already happening and it is highly likely that part of this warming is due to Greenhouse Gas (GhG) emissions that have been produced by humans (anthropogenic emissions). Furthermore, even if atmospheric concentrations of GhGs are maintained at current levels we are likely to experience further warming of the climate system which will bring with it a variety of impacts that will influence how and where we live. This means that we need to think about both reducing our emissions and adapting to future climate change impacts.

If left unchecked, emissions of global anthropogenic GhG emissions are highly likely to lead to further climate change, with damaging effects on physical, biological and chemical processes, bringing significant consequences at a variety of spatial scales. These changes will have an impact on Greater Manchester's environment, economy and society. The Intergovernmental Panel for Climate Change (IPCC) in their latest report, the Assessment Report 4 (AR4), produced the following table:

Table 1.1

Classification of recent stabilisation scenarios according to different concentration targets.

CO_2 concentration (ppm)	CO_2e concentration (ppm)	Global mean temperature increase above pre-industrial at equlibrium (°C), using "best estimate climate sensitivty"	Peaking year for CO_2 emissions	Change in global CO_2 emissions in 2050 (% of 2000 emissions)	No of assessed scenarios
350-400	445-490	2.0-2.4	2000-2015	-85 to -50	6
400-440	490-535	2.4-2.8	2000-2020	-60 to -30	18
440-485	535-590	2.8-3.2	2010-2030	-30 to +5	21
485-570	590-710	3.2-4.0	2020-2060	+10 to +60	118
570-660	710-855	4.0-4.9	2050-2080	+25 to +85	9
660-790	855-1130	4.9-6.1	2060-2090	+90 to +140	5

Source: Adapted from IPPC Working Group III Fourth Assessment Table 3.5
Note: Equilibrium temperatures assume a climate sensitivety of 3°C and are different from expected global mean temperatures in 2100 due to the inertia in the climate system.

The purpose of this table is to link atmospheric concentrations of CO_2 and the other GhG to differing levels of global warming. Separate charts, tables and information link these warming levels to climatic impacts. The first column of this table shows the concentration of CO_2 in the atmosphere and the third column the likely temperature rise associated if the atmosphere is stablised at this level of atmospheric concentration[1] at this level – i.e. remaining constant.

The fifth column displays the associated global change in CO_2 emissions associated with these targets. We are currently at 390ppm[2] of CO_2 - and this figure is rising at approximately 2.5ppm per year. If we assume, given the nature of the Copenhagen Accord, that there will be little change in our global emissions prior to 2015, then it would appear likely that we will exceed 400ppm of CO_2 by 2015. If we subsequently manage to stabilise our atmospheric emissions at this level, which would according to the table above require global cuts in emissions of up to 60% by 2050[3] – it would appear that we are already committed to an increase of 2.4-2.8°C – unless options such as atmospheric CO_2sequestration[4] are applied.

This level of warming, and the associated climatic change, will be observed differently across the world. Indeed the follow-on effects from this warming in terms of climate change will also see very different levels of impacts around the world. It is therefore important that whilst we are seeking to reduce our emissions, to prevent dangerous climate change, that we recognise what the science is telling us and we begin to implement adaptive measures within our planning system. It may be that we look at planning measures that deal with the climatic impacts of a world that is potentially some 4°C warmer – correlating with 485ppm CO_2 as shown in the table above – even though we are trying to achieve a lower level of warming.

[1]If we make assumptions about the other gases that have either a warming or a cooling effect.

[2]Measurement taken from the Mauna Loa Observatory, Hawaii, January 2010.

[3]Many of these reductions will need to be delivered prior to 2050 – due to the stock of GHG in the atmosphere – CO_2 for example stays in the atmosphere for 100 years.

[4]For example widespread application of biomass with Carbon Capture and Storage.

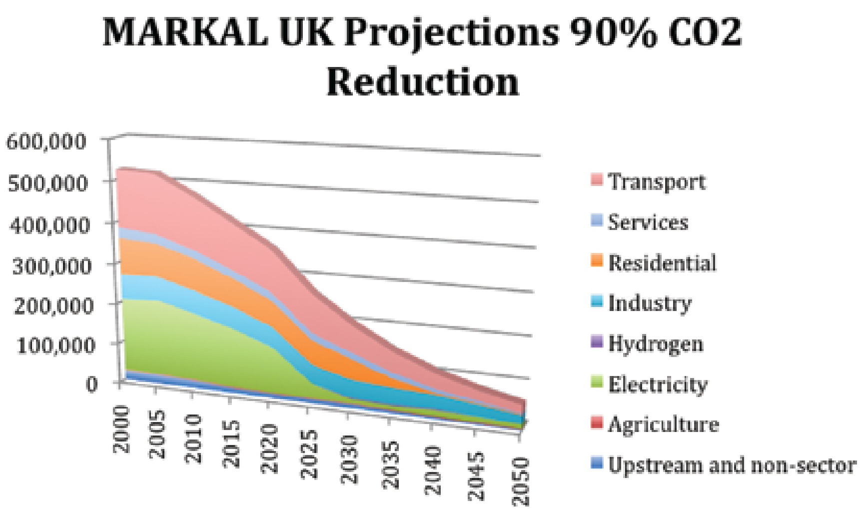
National Targets for emissions reduction

The Climate Change Committee (CCC) published its first report in December 2008. It suggested that GhG (all six Kyoto gases) emissions within the UK would need to be reduced by 80% on the year 1990, which, they stated, is the equivalent of a reduction of 77% on the year 2005. This is important as it shows that we do not need to focus on the year 1990 as a baseline year. In terms of the target the committee has since gone further and suggested that we will need to reduce our CO_2 emissions by 90% over 1990 – with this corresponding to a reduction of 89% on 2005[5].

It is important to note, when considering mitigation, the key issues of focus should be the development of a future ultra-low-carbon energy system - and the total amount of emissions released in the past and between now and 2050 – rather than the difference between 2050 and 1990/2005, it is these figures that will dictate the level of warming that we experience.

However, it is important to remember, in the same way that levels of reductions will differ between countries, absolute targets such as 90%, 80% or otherwise will bear, in many respects, little meaning without considering the sectoral (eg Transport, Residential, Industrial) reductions that underpin these reductions. For example, the CCC, who also used the table above, provided its assumptions to a team of MARKAL[6] modellers. They subsequently produced the chart below to show how different sectors may contribute to overall reductions. This shows differing levels of reductions in differing sectors between the year 2000 & 2050.

If we accept these projections, this would suggest that areas with a higher amount of industrial activity, would, if they continued to exhibit similar economic properties, need to reduce their emissions by less than 90% whilst other areas with little industrial activity may have to reduce their emissions by a higher amount in pursuit of the national target. Whilst paying their 'fair share' through pay-as-you-pollute policy regimes such as EU Emission Trading Scheme and the Carbon Reduction Commitment. Therefore, sub-national targets need to recognise the national context, and science, rather than arbitrarily adopting the absolute emissions target of the national level – whether it be in the short, medium, or long term. Any plan for CO_2 reductions associated with energy in Greater Manchester should recognise the regional, national and international contexts. It should recognise the availability of renewable resources both now and in the future and how Greater Manchester may be able to harness these. It is therefore intended that this report feeds this wider discussion, as policy is often best formed through a combined top-down and bottom-up approach.



[5] This reduction target is designed is to allow aviation to continue to emit CO2 at the same level as it did in 2005. It is this target that is the focus of this report and study.

[6] MARKAL is a least cost energy-economic model, in this case a constriction on CO_2 emissions in both 2020 and 2050 was applied to establish some potential pathways for reductions.

Shaping Targets for Greater Manchester

To facilitate an understanding of the responsibilities involved in achieving a 90% reduction in carbon dioxide emissions, the Greenhouse Gas Regional Inventory Protocol (GRIP) methodology was used firstly, to assess CO_2 emissions in Greater Manchester in 2005 and subsequently, to see how they may be reduced by 2025 and 2050.

The first stage of GRIP is to produce a CO_2 inventory, and this was provided for Greater Manchester for the year 2005. This is the earliest year for which the most reliable data is available for energy use statistics. It is also the baseline year adopted in this study. However, such an inventory only tells us where we are in terms of CO_2 emissions in Greater Manchester.

The science tells us that we need to stabilise atmospheric concentrations of CO_2 at a level which will prevent dangerous climate change – this is widely regarded to be a 2°C increase in global mean surface temperature – we already see as appears ambitious. The reduction target of 90% put forward by the CCC is linked to achieving a warming of approximately 2.4°C[9].

This, together with the MARKAL projections, suggests what reductions that Greater Manchester might need to make by 2050 and 2025. This leaves us with a key challenge: finding out how to get there.

How we measured Greater Manchester emissions?

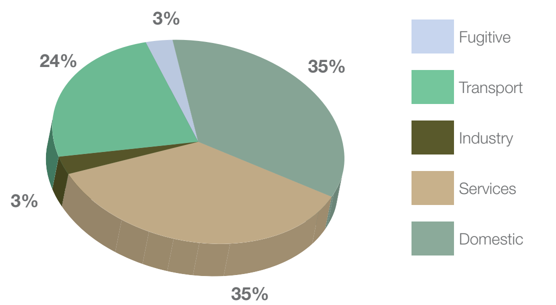
In this inventory we focus on CO_2 emissions from Energy. When compiling a CO_2 inventory, it is important to first understand the characteristics of the area under scrutiny, most notably its population, affluence and economic constituents. Correctly interpreted, this data points towards likely CO_2 sources and, additionally, engenders within the stakeholder an appreciation of the drivers within the region that currently affect CO_2 emissions.

Greater Manchester, birthplace of the Industrial Revolution, is home to 2.54m people[7] occupying 1.14m homes[8]. It covers an area of 1,276sq km[9] and is divided into ten local authorities. In terms of its size and population, Greater Manchester is more densely populated than the wider Government Office for the North West region and at the time of the last census it was the second most densely populated area in the North West region behind Merseyside[10]. In 2005, the economic wealth of Greater Manchester was approximately £42.3Bn equivalent to a Gross Value Added (GVA) per head of £16,628. This was lower than the UK average of £18,537 and ranked Manchester 14th in terms of wealth creation in comparison to other NUTS 2 areas[11].

In 2005, Greater Manchester accounted for approximately 4.1%of the UK's manufacturing output [11]. The public administration sector accounted for 12% of Greater Manchester's economy[7], with the commercial sector contributing 48%[7]. Over the 15 year period 1990-2005, Greater Manchester's economy has grown by 37%[7]. All emissions associated with the consumption and combustion of fuels are accounted for in GRIP and includes energy consumed in the home, transport, agriculture, industry and commerce. For the purposes of GRIP, emissions associated with the production of electricity are attributed to the consumer.

The CO_2 emissions from Greater Manchester totalled 17,875.08 (kt/y), accounting for approximately 3% of the UK's total CO_2 emissions in 2005[12].

2005 CO_2 Impacts (kt/y) with fugitive emissions



[7] Greater Manchester Forecasting Model

[8] AGMA (2008) Greater Manchester Housing Market Assessment: 65

[9] Office of National Statistics (2007) Standard Area Measurements [Online] Available at: http://www.ons.gov.uk/about-statistics/geography/products/geog-products-other/sam/standard-area-measurements.zip [Last Accessed: 9th March 2010]

[10] Office of National Statistics (2001) Population Density: by Local Authority [Online] Available at: http://www.statistics.gov.uk/STATBASE/Expodata/Spreadsheets/D5884.xls [Last Accessed: 9th March 2010]

[11] Office of National Statistics NUTS2GVA data 1995-2007[Online] Available at: http://www.statistics.gov.uk/downloads/theme_economy/NUTS2.xls [Last Accessed: 9th March 2010]

[12] For a detailed explanation of the energy & CO2 baseline used for the GRIP scenario process please refer to the "Greater Manchester Sustainable Action Plan 2010" available to download from www.manchesterismyplanet.com

What is the GRIP Scenario Process?

The second stage of GRIP is to tackle this challenge using its scenario process. To populate the tool requires a detailed understanding of the energy system, both within and beyond of Greater Manchester. This scenario tool is key to the stakeholder derived scenario process and was used to form the CO_2 orientated energy scenarios for Greater Manchester presented in this document.

Once the inventory has been produced, the results of the energy component are used to part-populate the GRIP scenario tool and process. An example of these can be found at www.grip.org.uk/scentool.html. Scenarios come in various guises and have been applied in a broad range of sectors including academia, business, industry and government. Their purpose is to provide an insight into how the future might unfold. These insights can be used to aid and inform strategic decisions taken in the present. In the case of a GRIP scenario exercise, a vision of the future is formed by the participants, the participants quantify this future in terms of a change in the demand for energy, the fuel mix and future generation technologies. The process is both qualitative and quantitative.

In the exercise, each participant uses a separate version of the scenario tool, enabling them to form their own scenario – as well as contributing to the overall scenario formed with a facilitator. The "GRIP Scenario Tool", or perhaps more aptly, "decision aid", therefore allows an individual or group of participants to explore the impact of potential mitigation measures on the total CO_2 emissions of the area under study. Within the scenario process undertaken using GRIP, the stakeholders are free to explore different energy options, revise their views, and perceptions of the future, or even drop the goal of the 90% reduction if they feel so inclined.

With the GRIP scenario tool, there lies the potential to produce a number of scenarios in an organic, iterative and exploratory manner. The scenarios produced may evolve as the participating stakeholders knowledge, beliefs and attitudes change. A scenario is not a single static vision of the future, but rather a logical sequence of images that make up the future. Kahn and Weiner[13] defined scenarios as: "…hypothetical sequences of events, constructed for the purpose of focusing attention on causal processes and decision points"[14].

A scenario is not prediction of how the future will unfold but rather a picture of how it may unfold[15]. Furthermore, while the degree of uncertainty associated with a scenario may be of particular interest to policy-makers, scenarios do not allow for the production of sensible, quantifiable level of certainty, quite simply, because we do not have statistics of the future to make such assumptions.

The use of scenarios at a sub-UK scale can enable the development of individually-tailored, specific plans and policies that will meet the requirements of central, devolved and regional government, and promote the consideration of the wider global community within such plans[16]. With this in mind, more targeted approaches to both a reduction in CO_2 emissions and climate change adaptation can be taken locally recognising regional characteristics and with an understanding of current physical, social and economic issues.

Scenario Workshops in Greater Manchester

The scenarios generated and presented in this brochure have been produced entirely through stakeholder engagement. These stakeholders included: policy makers, local councils, industry representatives, academics and non-government organisations. Manchester: Knowledge Capital hosted three one-day workshops and these included a total of 21 stakeholders (all of whom are listed at the back this report). The scenario tool and its application enables a scenario exercise to bridge the gap between a qualitative storyline that an individual or group holds or derives. These storylines allow for the pinpointing of quantifiable variables in terms of energy demand and supply and the emissions associated with that storyline. In so doing, a detailed perspective of social, economic, and wider environmental issues can be gained and included within the scenarios.

GRIP seeks to faithfully measure the views surrounding progress to date on mitigation initiatives and potential progress within the area under study, in this case Greater Manchester.

The only constraints on the scenario exercise are the purpose of the scenario and an individual's own imagination.

12 Nomenclature of Units for Technical Statistics

13 Kahn, H. and A. J. Wiener (1967). "The next thirty-three years: A framework for speculation." Daedalus 96(3): 705-732.

14 IPCC (2000). Emissions Scenarios. 2000: Special Report of the Intergovernmental Panel on Climate Change. N. Nakicenovic and R. Swart.

15 IPCC (2000). Emissions Scenarios. 2000: Special Report of the Intergovernmental Panel on Climate Change. N. Nakicenovic and R. Swart.

16 Shackley, S., P. Fleming, et al. (2002). Low Carbon Spaces Area-Based Carbon Emission Reduction: A Scoping Study, Sustainable Development Comission.

Summary of Greater Manchester Workshop Scenarios

There were three separate scenario sessions carried out for Greater Manchester, producing three scenarios. In this section, we compare the three scenarios. The results are presented over the next 6 pages. They look at how a CO_2 emissions reduction of 90% nationally may be achieved in Greater Manchester by 2050 and what this may mean for 2025.

These scenarios were all produced using the Greenhouse Gas Regional Inventory Protocol's approach to scenario formation. The sessions were all interactive and sought a balance between the discursive and quantitative elements deemed most pertinent when forming an energy emissions scenario. The drivers considered included all of the ones considered within the storyline components of the Special Reports on Emission Scenarios (SRES) of the IPCC.

The scenarios for Greater Manchester were produced with 21 different stakeholders from a variety of interest groups within and beyond of Greater Manchester, reflecting a range of backgrounds. The scenarios reflect inputs from all of the stakeholders as to how Greater Manchester may reduce CO_2 emissions by 2050 by the equivalent of 90%, however they should not be deemed representative of any individuals view. Two out of the three scenarios achieved the desired 90% reduction in CO_2 emissions; the remaining scenario achieved an 87% reduction. All of the scenarios reduced end user energy consumption by between 87% and 92%. Interestingly, the two scenarios that achieved a 90% reduction in CO_2 emissions reduced end user energy consumption by a fairly similar 40-46%.

When considering the results, it should be noted that the sessions were run independently of each other. Furthermore, in the two scenarios that achieved a 90% reduction economic growth was running at an average annual increase of at least 2.00-2.25%. Moreover, both the population of Greater Manchester and the amount of households increased in all of the scenarios. The reasons described by the stakeholders for this decoupling of economic growth from CO_2 emissions and energy consumption varied between the three scenarios.

It is also interesting to note that in most of the scenario sessions, the production of electricity from the National Grid became nearly carbon free. Where electricity was produced using fossil sources, this was usually combined with Carbon Capture and Storage (CCS). None of the scenarios had coal based electricity production without CCS. In all but one of the scenarios, electricity consumption sourced from the National Grid reduced, displaced largely by a greater uptake of on-site renewable technologies and Combined Heat and Power (CHP) units for electrical energy. In all of the scenarios, electricity consumption increased overall and there was similarity in the level of emissions reduction achieved in the domestic, services and road transport sectors – usually in excess of 85-90%. The rest of transportation, industry reduced their emissions by smaller amounts. The scenarios are helpful as they show a large degree of congruence between significantly different stakeholder groups. They also help to understand the urgent nature of mitigation, in the near-term, and the decisions that are necessary to deliver the emissions reductions to recognise the carbon cycle.

[13] Kahn, H. and A. J. Wiener (1967). "The next thirty-three years: A framework for speculation." Daedalus 96(3): 705-732.

[14] IPCC (2000). Emissions Scenarios. 2000: Special Report of the Intergovernmental Panel on Climate Change. N. Nakicenovic and R. Swart.

[15] IPCC (2000). Emissions Scenarios. 2000: Special Report of the Intergovernmental Panel on Climate Change. N. Nakicenovic and R. Swart.

[16] Shackley, S., P. Fleming, et al. (2002). Low Carbon Spaces Area-Based Carbon Emission Reduction: A Scoping Study, Sustainable Development Comission.

Scenario Workshop One

Economy and Demographics

Over the past five decades, Greater Manchester's economy has grown on average at a faster pace, relative to the rest of the UK. This represented a level of economic growth of 2.25% pa. Furthermore, the population has increased by more than 30%, This was partly due to an influx of migrant workers, climate refugees and a general desire of the wider populace to live closer to urban areas. With this increase in population has come an increase in households. Many of the recently constructed homes are small compact environments, built specifically with professionals in mind. In general the attitude to living in the north, particularly the North West and Manchester has become significantly more positive to living in the south of the country.

Residential Sector

The amount of non-electrical energy consumed in the domestic sector has reduced by 60%. This has been driven by a range of factors including behavioural change and an increase in the thermal efficiency of the housing stock, both old and new. In addition to this, there has been an expansion in the levels of CHP (Combined Heat and Power) usage – making more efficient use of fuel.

There has been no overall change in the amount of electricity consumed within the residential sector, despite an increase in homes and appliances used within them. There has been a significant increase in onsite power production, with onsite and local production now accounting for nearly 50% of electricity consumption within this sector.

Transport Sector

It has become relatively cheaper to use public transport rather than automobile transport, and it is a more pleasant and reliable experience. This is largely due to a much improved set of commuter links. However, it has not swayed everybody, although the decline in vehicle miles of 30%, despite the increased population, is an encouraging sign of more sustainable lifestyles.

Road vehicles are no longer dominated by oil, and are much more efficient on average than they were at the turn of the century. The majority of road vehicles in Greater Manchester are running on electricity, with hydrogen-based propulsion being the second most popular vehicle on the road.

Emissions from aviation have stabilised at 2005 levels, which required other sectors to reduce their emissions by higher quantities.

Electricity Generation

There are no longer any fossil based power stations within the north-west either with or without carbon capture and storage. The majority of electricity production in the region is from off-shore wind. This is largely due to the significant off-shore capacity of wind on the coast. The second most prevalent generation technology in the region is nuclear power, which continues to occupy a sizeable share of production despite public opposition. The tidal barrage in the Mersey Estuary has now been built, bolstering the regions renewable supply. In the wider UK the amount of electricity produced from fossil fuels has reduced considerably to just 15% with two thirds of this coming from Coal with Carbon Capture and Storage. The remaining natural gas plants that are not fitted with capture technologies are used at times when electricity is in peak demand.

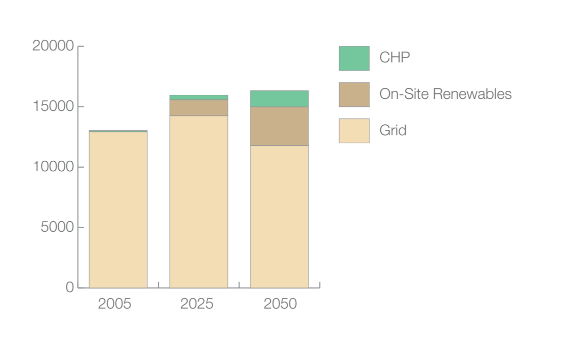
Service Sector

The amount of non-electrical energy consumed has reduced in line with the domestic sector. When this reduction is considered alongside strong economic growth and an increase in population, this change in energy consumption represents significant efficiency improvements. The production of electricity on-site has not resulted in the same levels of decentralization as seen in the residential sector.

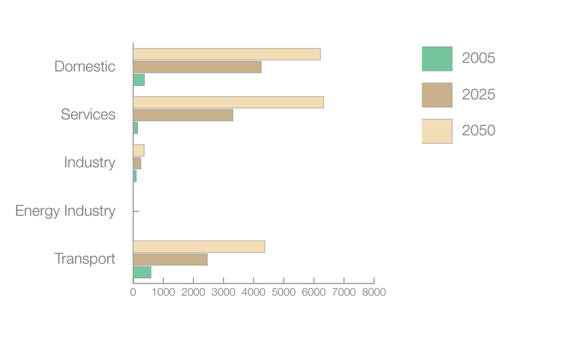
Industrial Sector

The lowest levels of emissions reduction have taken place within industry. This is largely because the industrial sector has remained dominated by fossil fuel combustion as it is seen as the best placed sector for making use of the fossil fuels. As a consequence, whilst industry has contracted and become more knowledge-intensive, total non-electrical energy demand has reduced by half – all of it natural gas.

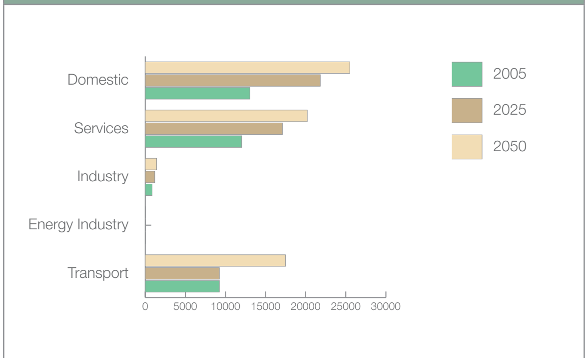
Electricity Production



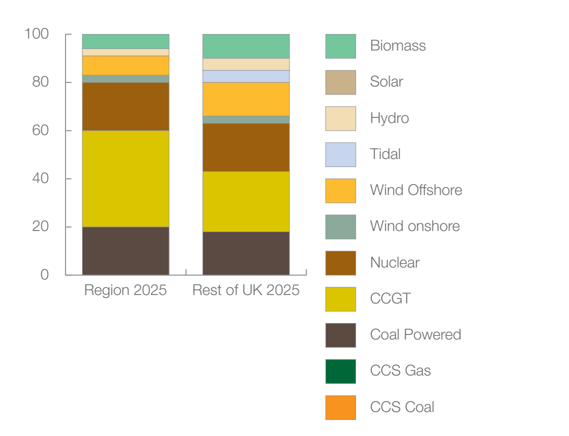
Emissions Change



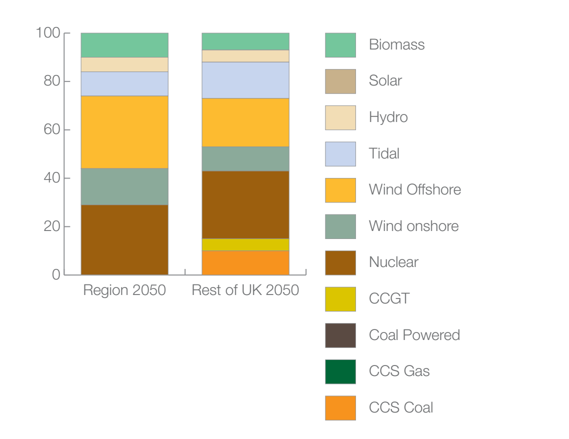
Energy Change



Electricity Production 2025



Electricity Production 2050



Scenario Workshop Two

Economy and Demographics

Since the turn of the century, Greater Manchester's economy has grown. This has represented an average level of economic growth of 0.5% pa. This seemingly low level of growth was faster than the national average. The population has increased moderately, but it is aging. With this increase in population has come a small increase in the amount of households. In general there has been a change away from a consumerist mindset to one where people place more value on their quality of life.

Residential Sector

The amount of non-electrical energy consumed in the domestic sector has fallen by 75%. This has been driven largely through retro-fitting and an improvement in building standards. Fossil fuels do still account for half of the fuel consumed in this sector. There has been a 20% decline in the amount of electricity consumed within the residential sector, despite an increase in homes and the number of appliances used within them. A quarter of the electricity consumed is produced through on-site renewable production.

Transport Sector

Due to a range of demand focused policies, the total amount of vehicle miles traveled over the past five decades has remained largely unchanged. This was partly aided by a lower than expected population increase. Approximately one fifth of vehicles on the road are powered using petroleum, the remainder using electricity. Overall, the vehicles are much more efficient on average than they were at the turn of the century. Hydrogen is emerging as a dominant mode, providing for a quarter vehicles which are ultimately powered by electricity. Emissions from aviation have stabilised at 2005 levels.

Electricity Generation

There are no longer any fossil based power stations within the North West either with or without carbon capture and storage. The majority of electricity production in the region is from nuclear power, with off-shore wind production coming a close second. The next most prevalent generation technology in the region is tidal power, which occupies a sizeable share of production despite public opposition. In the wider UK the amount of electricity produced from fossil fuels has fallen to approximately one fifth of supply with the significant majority of this coming with CCS. The remaining natural gas plants that are not fitted with capture technologies are used at times when electricity is in peak demand. More than half of overall electricity supply is from renewable technologies.

Service Sector

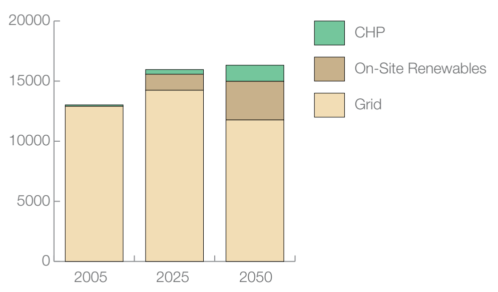
The amount of non-electrical energy consumed has fallen by 60%. This reduction should be considered in line with the economic growth experienced. This change in energy consumption represents significant efficiency improvements. The amount of electricity consumed has declined by 20%. The production of electricity from on-site renewable technology now occupies 30% of the total electricity consumed in this sector.

Industrial Sector

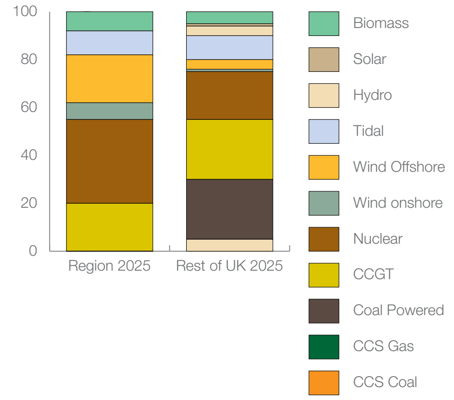
The industrial sector has reduced its emissions, but not by the same levels as the other sectors.

This is due to a combination of factors, firstly that industry has grown in size due in part to an increase in knowledge intensive industry. Fossil fuels remain the dominant fuel which means that emissions have remained higher than in the other sectors.

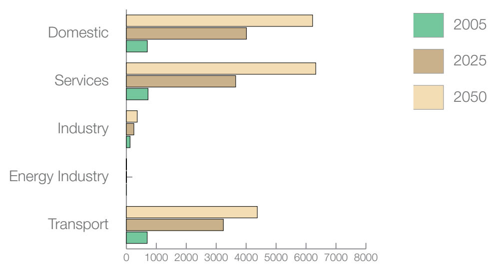
Electricity Production



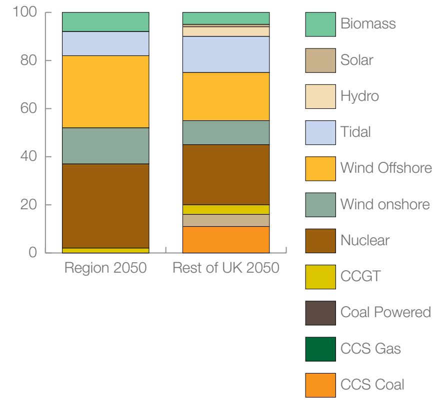
Electricity Production 2025



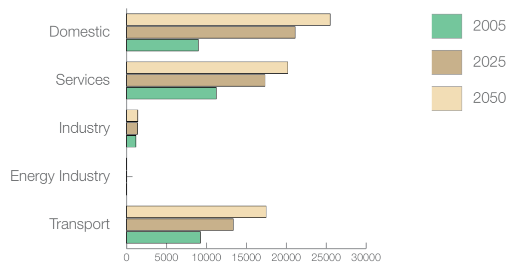
Emissions Change



Electricity Production 2050



Energy Change



Scenario Workshop Three

Economy and Demographics

Over the past 40 years, Greater Manchester's economy has grown on average at the same pace as the rest of the UK. This level of growth averaged 2.2% pa over this period. The population has increased at a faster rate than the rest of the country. With this increase in population has come a proportionate increase in the amount of households. In general, the quality of life of someone living in Manchester is perceived as relatively higher than in many other parts of the UK.

Residential Sector

The amount of non-electrical energy consumed in the residential sector has reduced by 60%. This has been driven largely through retro-fitting, behaviour change, the cost of fuel and an improvement in building standards. Fossils fuels, now account for one fifth of fuel consumed within this sector. There has been a 90% increase in the amount of electricity consumed within the residential sector. This is primarily due to an increase in homes and the appliances used within them. Even with this near doubling in electricity consumption, a fifth of the electricity consumed is produced through onsite renewable production.

Transport Sector

The amount of vehicle miles traveled has increased by 10% since the turn of the century, as people are more conservative with their use of motor-vehicles. Over this period there has been a range of largely technologically focused policies that has enabled this change to come about.

None of the vehicles on the road today are propelled by petroleum. In 2050, 50% are propelled by electricity, 40% by biofuel with the remainder powered by hydrogen. Overall the vehicles are much more efficient on average than they were turn of the century. Emissions from aviation has stabilised at 2005 levels.

Electricity Generation

There continues to be fossil fuel based power stations within the North West with every station being fitted with carbon capture and storage. The majority of electricity production in the region is from nuclear power, with off-shore wind production also playing its part. The next most prevalent generation technology in the region is onshore wind production. In the wider UK, the amount of electricity produced from fossil fuels has remained high at 40% of supply, although all of it has been produced at sites utilising carbon capture and storage. Nuclear power accounts for a quarter of supply with the remainder coming from a mix of renewable technologies.

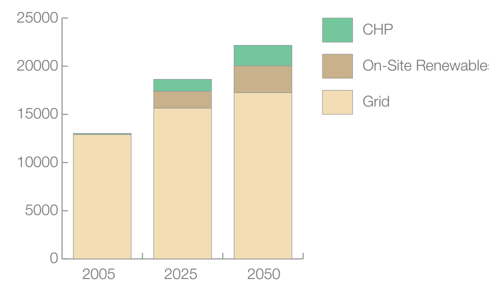
Service Sector

The amount of non-electrical energy consumed has fallen by 65%. This reduction should be considered in line with the economic growth experienced. This change in energy consumption represents significant efficiency improvements. The amount of electricity consumed has increased by 20%. The production of electricity from on-site renewable technology now occupies 10% of the total electricity consumed in this sector.

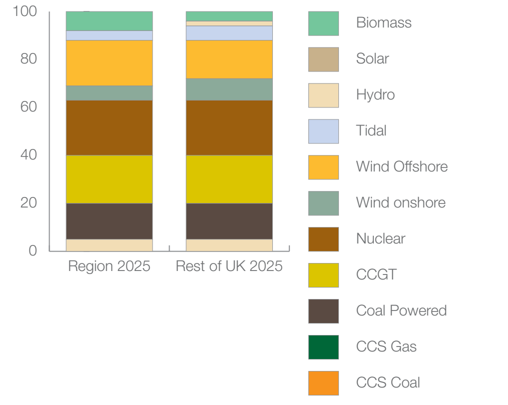
Industrial Sector

The industrial sector has reduced its emissions, but at a lower level than the other sectors. This is largely caused by the ongoing use of fossil fuels within this sector, due to industry finding it harder to reduce its emissions by switching to other fuel sources. In addition industry has declined in relative comparison to the other sectors in the economy.

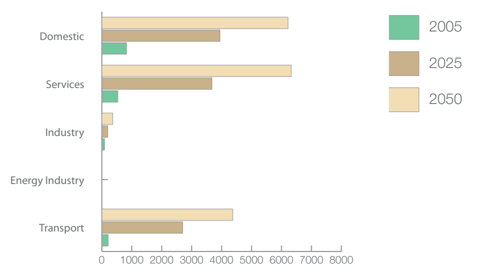
Electricity Production



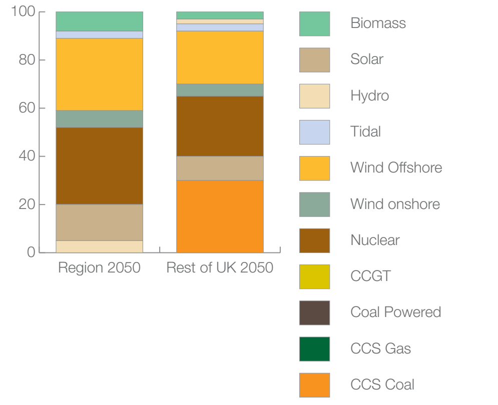
Electricity Production 2025



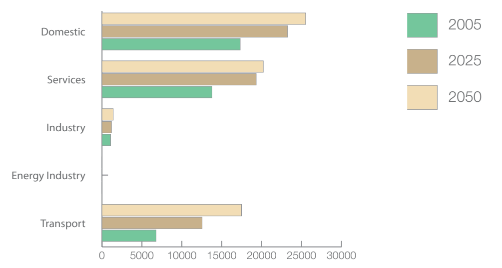
Emissions Change



Electricity Production 2050



Energy Change



Summary

Social Learning for Greater Manchester

Over the three days of workshops, the participants collectively invested over 150 hours of their time in shaping the scenarios featured in this report. The process by which the scenarios were co-created yielded an output perhaps of greater value: that of social learning by professionals from a wide variety of backgrounds.

In an attempt to capture this social learning, the organisers recorded observations throughout the duration of the workshops. This was complemented by participants providing structured written feedback. A summary of this learning is as follows:

1) Appreciation of the scale of challenge

The introductory session to the workshops, (which gave a synopsis of the IPCC reports in relation to current CO_2 concentration levels, rates of emissions and predicted global temperature rise), was a genuine shock to the majority of attendees.

Clearly few of the participants had previously had the opportunity to look beyond the IPCC headline statistics. In these sessions they were able to gain, through interaction with a well informed intermediary, an appreciation of the urgency to reduce CO_2 emissions to meet both carbon targets and budgets. Furthermore, the science highlighted the need to develop strategies to increase our resilience to a changing climate.

“It has become clear that the biggest constraint is the lack of understanding of decision makers of the scale and urgency of the challenge”

2) The benefits of co-creation

The process of co-creating energy scenarios enabled participants to engage in a well researched, structured and supported debate, focused on a very practical task of reshaping the energy system. Each workshop was prefaced with the statement that ‘there is no such thing as an energy expert of the year 2050’, which helped participants relax into a supported learning environment. This helped to nurture the sharing of knowledge, views, and asking of questions from a variety of perspectives.

“I enjoyed hearing the thoughts of my peers in their professional capacity and having the chance to develop a scenario with them”

3) Yes, we can make the step change

One outcome common to all workshops was an increased appreciation of the level of change required to reduce CO_2 emissions. All of the workshops achieved very significant CO_2 reductions of 87-90% by 2050, through complete transformation of the energy system and associated infrastructure. Most fundamentally this was achieved whilst population and economic growth continued. Many of the stakeholders took the position that this sustainable energy revolution would provide growth, reduce CO_2 emissions and improve security of supply.

However for this to come to fruition, a collective view was formed of the necessity for strong leadership and commitment at national and local levels. This was felt to be vital to drive the innovation and create the financial incentives needed to achieve a step change in our energy habits and systems.

“I’m much more informed about the opportunities and constraints of the UK energy systems”

4) The area under the graph

The stakeholder sessions highlighted that national policy targets will only take us so far in reducing CO_2 emissions and that regional, sub-regional and local polices will be needed to meet the remaining CO_2 targets. It was also established that CO_2 targets will need to be continually reviewed and carbon budgets met. It became clear that the longer CO_2 is emitted at today’s levels, the harder it becomes to stabilise concentrations of CO_2 in later decades. Focusing on the total CO_2 that we release over time, rather than annual emissions in 2050, is therefore essential.

Whilst many participants had commenced the workshop with the view that it was possible to achieve the CO_2 reductions required, the GRIP Scenario Tool enabled them to identify how this could be delivered. The scenarios also demonstrated that thermal comfort levels in buildings, continued mobility and access to power, considered to be essential for an acceptable quality of life, could be maintained

Next Steps

It is hoped that this report contributes to wider learning and appreciation of the challenges and opportunities presented in shaping a low-carbon future. The principle of co-creating future energy pathways will be continued in the finalisation of Greater Manchester’s Sustainable Energy Action Plan (SEAP) during 2010 (see pages 4-5).

It is hoped that the SEAP process will be embedded in the Greater Manchester framework to develop coherent, evidence-based and prioritised action plans. It is anticipated that the SEAP process will provide a structured framework to drive forward the transformation of an energy system that is affordable, competitive, secure and low-carbon.

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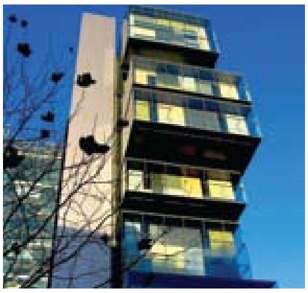

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