CONNECTED: THE GREATER MANCHESTER ENERGY PLAN

FULL REPORT.

POWERING GREATER MANCHESTER'S
LOW CARBON FUTURE.

GREATER MANCHESTER
ENERGY GROUP

This report comprises an overview supported by a number of issue specific reports which aim to address the desired outcomes and actions above. Their purpose is to equip senior decision-makers across GM with a core understanding of GM's energy infrastructure, opportunities and challenges, and to enable key actors to take a stake in the delivery of a low carbon, affordable energy future.Together, they comprise Greater Manchester's Energy Plan.

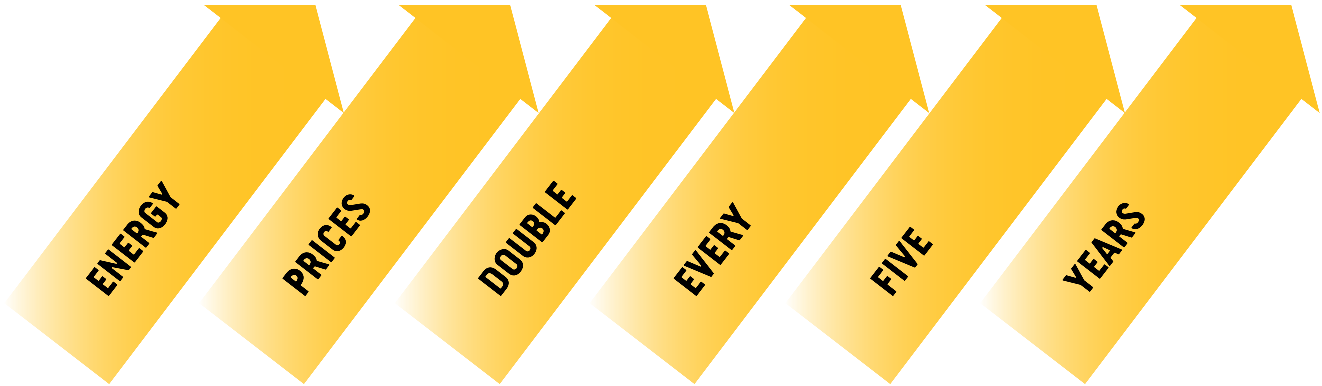
The reports include:

Report 1 **GM Energy Use**	An insightful guide to our consumption using current methodologies and an indication of GM's future footprint. What might we expect to use in future? How do we reduce the amount we use, and make better use of available supplies?
Report 2 **Energy infrastructure**	A guide to how it works, where it is and what kind of shape it's in, plus more on how we need to enhance it, including 1–2 page overviews and actions on: — Electricity Generation — Distribution of gas and electricity, (including smart networks and storage) — Heat
Report 3 **The energy market**	The 'big six' suppliers and the key players across the energy system. How they operate, and the implications of this market's future for GM, including key market challenges, such as price, energy security, climate change and fuel poverty.
Report 4 **Low Carbon Goods and Services sector**	Update and refresher briefing around GM's market presence and strengths in low carbon goods and services, and the actions needed to sustain its growth.
Report 5 **Sixth wave innovation**	Briefing on the future of low carbon and clean technologies and how we unlock opportunities to ride a 'sixth wave' of global innovation, including GM's substantial R&D base.
Report 6 **Regulatory framework**	A briefing on the rapidly changing world of regulation in Europe and the UK, with new Government guidance emerging and reviews of existing mechanisms (e.g. FiT). Suggestions on the position GM needs to adopt to shape the framework.
Report 7 **Low carbon investment**	Critical question examined – how do you fund a low carbon revolution? What are the payback periods and mechanisms? What impact will the carbon price have?
Report 8 **Working together**	The governance and delivery arrangements for how GM will work together, and who does what.
Report 9 **Action Plan**	A summary sheet of identified interventions and projects.

OVERVIEW

Energy generation, distribution and use are fundamental parts of modern society. Greater Manchester needs this plan to secure its supplies of energy in the future. Climate change, price fluctuations and increases and the availability of fuel are pressing challenges across the whole of the Greater Manchester area.

This plan sets out the current situation, potential issues and proposed solutions to make sure the lights stay on in Greater Manchester. It has been developed by the Greater Manchester Energy Group, which comprises a mix of public and private sector leaders who work together to support the delivery of a secure, affordable low carbon energy future for Greater Manchester, and was endorsed by the Association of Greater Manchester Authorities (AGMA) Executive in November 2011.



CHANGING TIMES

We depend on power for warmth and shelter, and for our modern lifestyles of work, travel, communication and leisure. The availability and price of energy has a significant impact on everyone's lives, and even slight disruptions or price volatility can lead to civil emergencies and financial crises. Since the 1970s, the success of the national grid and plentiful supplies of cheap UK gas have meant energy supplies have been affordable, and power outages have been minimal for the majority of the general public.

Cities including Manchester led the first energy revolution, with local and municipal enterprises putting in place the building blocks of the UK's energy system. In the second half of the 20th Century, energy increasingly became a national concern, with national government setting the agenda, and, following privatisation in the 80's and 90's, national companies delivering the solutions. Now, price volatility, decentralised energy and the transition to a low carbon economy are highlighting a mismatch between our current system and the UK's energy needs. This means that for the first time in over half a century, the role of cities in identifying, financing and delivering energy infrastructure is vital. European and UK strategies for delivering a secure low carbon energy future place cities at the centre, and cannot be achieved without their leadership. This means Greater Manchester needs to act.

As the UK increasingly relies on imported or harder to extract fossil fuels, and with over a quarter of our generation plants needing to be renewed before the end of the decade, the costs of trying to maintain our current system are unaffordable. Greater Manchester's businesses and residents will be economically disadvantaged if an alternative approach is not delivered, and fuel poverty is a real and increasing concern. In recent years, energy prices have been doubling every five years, and although this is likely to continue, the impact of such increases can be kept to a minimum if Greater Manchester reduces its energy consumption, adopts low carbon technologies, innovates in network use and times its energy use to make best use of affordable, low carbon energy assets. Greater Manchester will always need to consume energy sourced from other parts of the UK. Early investment in low carbon, local energy demand reduction, management and generation solutions are the least expensive ways for GM to meet its energy needs. In the longer term, equipping homes and businesses with the ability to store energy to balance their demand to times when supplies are abundant could become an important feature of GM's energy system.

If Greater Manchester is to have a secure low carbon energy system and strong low carbon economy then a combination of influencing, innovation, market development and practical projects to make better use of low carbon energy, reduce energy demand and diversify supplies will be needed. The energy market is highly complex, partitioned and regulated, and GM does not fully control its energy system. Achieving a low carbon, secure and affordable energy system in Greater Manchester will require a concerted effort to increase local accountability, promote local trading and local influence on the energy market. No single player can act alone.

For the private sector, the challenge will be delivering long term investment. For the public sector, this is a test of multi-level governance; co-operation between European Institutions, national and local government to engage the private sector and deliver the right measures at the right level.

RISING TO THE CHALLENGE

Challenges which will affect Greater Manchester include:

Carbon emissions reduction and associated market drivers;

Ageing and vulnerable distribution infrastructure, which needs to adapt to new connection, management and two-way flow requirements;

A drop in UK generation due to the decommissioning of old nuclear, gas and fossil fuel power stations;

The price, availability and impacts both of energy sold to consumers, and of fossil fuel extraction, distribution and use;

Increasing electricity demand associated with uptake of digital technologies, and, in the mid term, switching from fossil fuels to electricity for heat and transport;

Challenges of changing energy systems, use and behaviour to capitalise on times when intermittent renewable supplies are abundant and network capacity is available;

Identifying opportunities and locations for new energy generation and distribution infrastructure.

Harnessing the substantial economic opportunities arising from the changing ways in which the world will meet its future energy requirements;

Making sure we have the skills, expertise and knowledge needed to deliver GM's future energy system.

These challenges have a real impact on the economy and social wellbeing of Greater Manchester. If we get it right, the measures we take to deliver secure, low carbon energy supplies have the potential to strengthen the resilience of the system and stimulate sustainable economic growth while also lifting people out of fuel poverty. This can be achieved via reducing consumption, providing affordable supplies and creating employment opportunities. Although the actions needed to deliver this require significant investment and changes in lifestyles, the costs of business as usual are already having a negative impact on the quality of life, solvency and economic performance of Greater Manchester's residents, organisations and businesses.

Climate change is inconvenient for our current, oil-based economy, and it is easy to be focussed on more immediately visible challenges like war or poverty. However, climate change is an increasingly recognised causal factor of current conflicts and poverty. If we don't deal with climate change now within this decade, the consequences — as defined by a global consensus of scientific, social and economic experts — are a rapid decline of available land, water and food accompanied by extreme and volatile weather changes which have already started, and which will catastrophically damage the ability of the planet to support human life within the lifetime of our children.

GM'S VITAL STATISTICS

GM generally uses more energy per capita than UK average; however this is primarily due to its high commercial activity levels as an economic and employment centre, rather than a presence of significant industrial energy users, or high energy use in homes. When normalised against economic performance, GM generates more £ of GVA per unit of energy used than anywhere in the UK other than London, mainly due to a high proportion of commercial and retail businesses within the economy. A high number of 'hard to treat' homes means that the energy used to heat homes across GM is slightly higher than would otherwise be expected for GM's socioeconomic profile.

In 2009, GM used 25.8 TWh of gas and 11.7 TWh of electricity. Around 20 TWh of petroleum products were used for transport activities. Since 2005, gas and electricity use have decreased by 17% and 9% respectively, with the commercial sector achieving the most significant efficiencies. Despite a decrease in energy use over the same period, in 2010 the average GM household spent over £1,100 on gas and electricity, an increase of 20% since 2007. Similar price increases in the commercial and industrial sector have had a significant impact on company profitability. In total, GM spent over £5 billion on its energy bills during 2010.

In 2005, GM's direct CO2 emissions were a little over 18 million tonnes, decreasing by just under 4% to around 17.5 million tonnes by 2008. National datasets would suggest GM may expect a slight increase in emissions in coming years as some of the 2008 reduction can be attributed to weather and economic factors.

GM's highest profile renewable energy generation schemes include the Scout Moor Windfarm, Co-op Group Solar Tower, Barton Locks hydro project and a number of waste water treatment, solar and landfill schemes. Four groundbreaking anaerobic digestion plants and a combined heat and power scheme will use Greater Manchester's waste to produce 8MW of energy, 83MW electricity and 5MW heat respectively. Uptake of decentralised and building integrated renewable energy generation is increasing, and new hydro, geothermal, wind, airsource heat and biomass generation opportunities are being actively pursued.

Greater Manchester's electricity is supplied via Electricity North West's distribution network which stretches between 2.4 million properties providing over 23TW of power to the North West via 13,000km of overhead lines and 44,000km of underground cables. Over the coming five years, over a £billion will be invested to maintain the network and adapt it to meet new economic and environmental challenges.

HOUSEHOLD ENERGY COSTS 2007 = £880

HOUSEHOLD ENERGY COSTS 2010 = £1100

20% INCREASE

STRONG FOUNDATIONS

Greater Manchester has a relatively small amount of large scale energy generation infrastructure, and does not host a major energy supply company. However, it has a higher than average proportion of energy sector companies, a track record of network innovation, higher than average energy sector employment and growth and its universities host energy research programmes in excess of £100 million in value. These are the foundations on which Greater Manchester needs to build its interventions if it is to realise the benefits of a rapid transformation to a low carbon economy.

At the international, national and local level, there is a significant gap between the levels of investment, innovation and transformation we know will be needed to meet climate change and energy security challenges, and the existing and planned actions already in place.

AND SO... THE ENERGY PLAN

Against this uncertain landscape, Greater Manchester needs to consider, and plan for a number of different future scenarios. Nevertheless, there are a significant number of critical actions that need to be undertaken now if Greater Manchester's businesses and residents are not to be disadvantaged from the radical transformation that our energy system will undergo.

There is a significant inter-relationship between this plan and the Greater Manchester Climate Change Strategy. This plan aims to progress the energy challenges identified in the Strategy, and will form a key bridge between the Strategy and its implementation arrangements. The detailed programme of activities being undertaken to deliver the Energy Plan will be included in the Climate Change Strategy implementation plan.

This Plan provides a strategic overview of the market, legislative and policy context, including the key drivers and challenges affecting the energy system. It identifies the actions and opportunities already in place within Greater Manchester to address these, and recommends the steps needed to address the gap between targets and actions in a way which aims to strengthen Greater Manchester's economic, social and environmental performance.

The energy efficiency of Greater Manchester's building stock is central to Greater Manchester's energy future, and essential to the delivery of climate change and energy goals. Recognising that the vast majority of energy is consumed in buildings, the steps being taken make sure new buildings use less energy and existing stock improves its performance warrant their own, detailed plan. Other than summaries to provide core assumptions about building's impact on energy demand and supply, further information on this detailed building level activity will be presented elsewhere as part of the Climate Change Strategy, Retrofit Plan and other strategic plans from the Greater Manchester Low Carbon Hub's Building Group.

This plan focuses specifically on strategic energy issues, and on the 'beyond doorstep' challenges and actions relating to generation, distribution, use, markets, networks and prices that will deliver a robust energy system.

OUTCOMES

If GM is to succeed in achieving its social and economic objectives, it will need to invest in its energy infrastructure at a scale equivalent to its previous investments in transport and regenerating the built environment. The development of a long term, stable investment platform and robust energy skills base to deploy a mix of high volume, small scale energy schemes, network innovations and large energy projects are therefore top priorities.

As already identified in the Climate Change Strategy, key energy outcomes by 2020 will be:

Invest	To have created market conditions which promote low and zero carbon energy generation and distribution opportunities across Greater Manchester, including local renewable power stations, leading and facilitating the development of local heating, cooling and smart grid networks and integrating microgeneration opportunities into our new building development standards and retrofitting programmes; Continued support and investment in UK renewable and low carbon energy generation via our energy procurement strategies; and Work to increase the size, economic and jobs contributions of Greater Manchester's energy sector.
Inspire	For users to understand that the cost and carbon impact of their energy use is linked to their patterns of consumption, and have access to support systems and schemes to help both reduce demand, and balance capacity, demand, carbon and cost – we have the opportunity to demonstrate national leadership in this area.
Plan	To have strengthened our understanding and ensured that existing and planned energy infrastructure is secure, resilient to the impacts of climate change, changes in energy use and the connection of local low carbon supplies, and to have integrated energy security issues into our planning for civil contingencies; and To have developed an understanding of the need to decarbonise the energy supply at community and household level, ensuring that the benefits of both reducing emissions and ensuring a secure and affordable future energy supply are applied in the planning of energy infrastructure at neighbourhood level.
Innovate	To be early adopters of smartgrids, smart technologies and energy storage, improving the efficiency of our energy system; To create new ways of buying, selling and trading energy which better align market forces with the development of a future fair, clean energy system. To have created market opportunities for the £100 million of energy research being undertaken by Greater Manchester's universities; and To have integrated the development of new heating and cooling networks and the establishment of locally generated power networks with the development of major retrofitting programmes and role out of smart technologies in order that networks can expand as heat demand from retrofitted property decreases;

To achieve these outcomes GM will:

Invest	Deliver a co-ordinated approach to actively support the development and delivery of local energy generation and network projects, focussing initially on a discrete number of schemes across renewables, distribution, smart grids, pricing, charging and storage that demonstrate technologies and commercially viable investment models for further development; Deliver a low carbon investment framework that provides and recycles access to cost effective capital for low carbon projects; and Maximise the take-up of international, national and local financial instruments including securing a robust local share of grants, low cost finance, including feed in tariffs, energy levies and the Green Deal.
Inspire	Deliver a co-ordinated communications programme, promoting energy training and 'carbon literacy', making energy use and carbon emissions publicly 'visible', including a rapid and accelerating roll out of smart meter and energy information technologies to encourage informed use of energy; and Influence the development of energy programmes to ensure that training and supply chain support are integrated into their development.
Plan	Deliver a spatial strategy and policy instruments which optimise collaboration between District Core Strategies, the National Planning Framework and local opportunities, and create a robust, transparent and supportive framework. This should actively support significant amounts of new low carbon generation, ensure that fossil fuel based-proposals are aligned with our ambitious carbon reduction and low carbon economic goals and engages communities, particularly around the need to balance large and small scale generation and secure locations for energy infrastructure which align with local interests and amenity concerns and deliver local economic benefits; Influence existing and new energy generation and distribution companies to ensure they have effective strategies for resilience, adaptation and the upgrading of networks, and the connection of low carbon technologies; and Make sure that core issues such as fuel poverty, energy security, infrastructure costs and achieving market competitive advantage cut across the full range of Greater Manchester's programmes and interventions.
Work together	Enable the right market conditions to be developed to promote investment and action in Greater Manchester via the Energy Group's governance and partnership arrangements which promote strong working relationships with key energy organisations.

CONNECTED: REPORT 1
OUR ENERGY USE

1.1 OVERVIEW

In 2009, GM used 25.8 TWh of gas and 11.7 TWh of electricity (this amount of energy is equivalent to boiling a full kettle of water around 250 billion times). Since 2005, GM's gas and electricity usage has decreased by 17% and 9% respectively, with the commercial sector achieving the most significant efficiencies. Despite a decrease in energy use, in 2010 the GM's average annual household gas and electricity bills increased by 20% between 2007 and 2010 to over £1,100, and a further price increase of 25-30% per unit of electricity is anticipated by 2015. Similar price increases in the commercial and industrial sector have had a significant impact on company profitability. In total, GM spent over £5 billion on its and insert 'energy' bills during 2010.

By 2020, based on national forecasts, it is expected that GM's total energy demand will be broadly similar to 2010. Within this, gas and transport fuel demand is forecast to decrease, and demand for electricity is expected to increase. If GM delivers on all currently identified opportunities, as much as 20% of GM's energy could come from renewable and low carbon sources, however, public perceptions on the acceptability of certain technologies, the environmental sensitivity of particular locations, uptake rates of domestic scale technologies a and challenges in securing project development finance mean that a target of 5% is more realistic.

GM has a commitment to achieve a 48% reduction in CO_2 emissions between now and 2020. As the vast majority of GM's CO_2 emissions are derived from its use of energy, achieving this target will require a significant transformation of the type, timing and quantity of energy consumed in GM. There is currently a mismatch between the target, and the pipeline projects in place to transform the energy system. The Plan therefore focuses on the Project development, financial and other actions needed to secure the necessary projects. This will need to be supported by a substantial change in the way that people and businesses use and trade energy, affecting all aspects of travel, work, home and leisure. If done right, this has the potential to be positive change which actively enhances health, quality of life and prosperity.

Since 2005, although gas and electricity use has decreased, the proportion of energy used as electricity has increased, and this trend is expected to continue as digital technology and electrical heating and transport demand increases. Although electricity and gas are the focus of this report, a high level understanding of transport fuel use has also been included below. This is because transport activities consume significant amounts of energy, and market analysis indicates that over coming years, transport fuels will increasingly shift from diesel and petrol to electricity due to increased usage of electrically powered public transport and, in later years, electric road vehicles.

The amount of emissions associated with energy use varies according to the type of fuel used. To illustrate the point, the following diagram shows where Greater Manchester's energy came from in 2005, in what sector the energy was used in and the resultant CO2 emissions. Noticeably electricity used in the commercial and industrial sector comprises a much larger proportion of emissions than energy supply. Gas is cheaper per unit than electricity, so similar trends can be observed when comparing energy use to energy costs. However, it is important to note that just as energy is lost as waste heat during electrical generation processes and via using inefficient appliances, energy is also lost as gas is burned in the home for heating or cooking, meaning that the useful energy yield of gas is considerably lower than the actual amount of gas purchased.

ENERGY CONSUMPTION AND RESULTANT CO_2 EMISSIONS 2005

1.2 GREATER MANCHESTER'S ENERGY MIX

The data below establishes a baseline for 2005, from which GM's performance can be tracked in future years. 2005 has been used, as this is the first year for which accurate energy use information was made available at the local authority / GM scale.

Gas	Natural gas accounted for 48% of GM's total energy consumption, and 33% of GM's total direct CO_2 emissions in 2005. Gas is primarily used to heat buildings; other uses include cooking, (domestic and industrial), and the production of hot water, steam and other types of heat for industrial processes.
Electricity	Electricity accounted for 20% of GM's total energy consumption in 2005, and 36% of GM's total CO_2 emissions in 2005.
Transport Fuels	Transport fuels accounted for 27% of GM's total energy consumption in 2005 and 25% of CO_2 emissions, in a 50:50 mix of petrol and diesel.
Petroleum Products	Petroleum products accounted for 4% of GM's total energy consumption in 2005 and 4% of 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.
Other Fuels	Less than 1% of GM's energy consumption was met using other fuels, mainly solid fuel (this includes Manufactured Solid Fuel (MSF), coal and wood). The drive for low carbon fuels has produced a growth in the use of biomass (solid fuel derived directed from plants) and planning applications suggest that this could increase in the future.
Renewable And Low Carbon Energy	There is no reliable data for the utilisation of renewable or low carbon electricity and heat in GM, however it is anticipated to be less than 0.5% of total demand.
Profile of Energy by End Use	It is important to note that when end use is considered, the vast majority of energy is actually used for heating purposes, followed by transport and then non-heat electricity consumption. This means that GM's approach to heat is key to delivering a secure energy future. The implications of this are explored in Report 2, Energy Infrastructure.

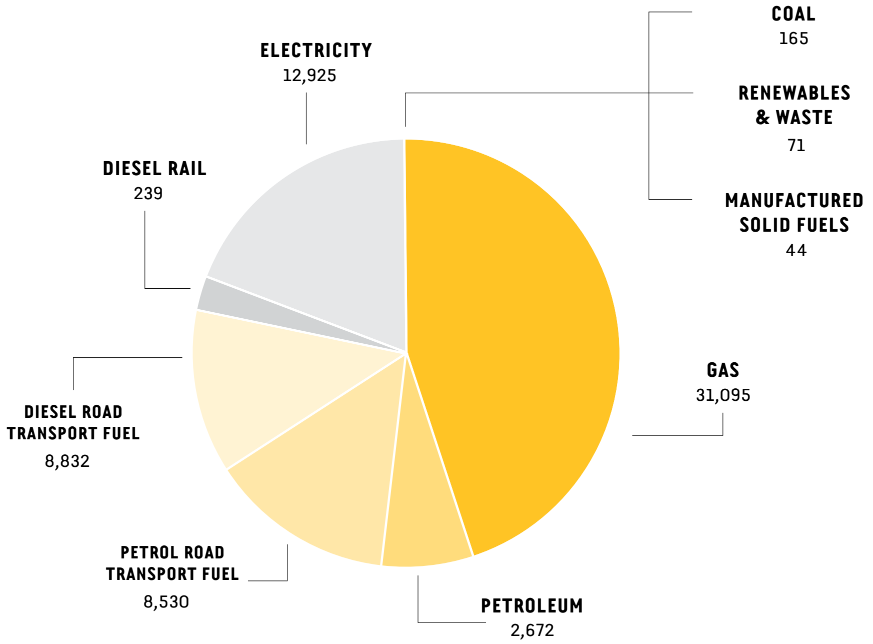
1.3 IMPACT OF ENERGY MIX ON CO_2 EMISSIONS

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 and 36% from Commercial). The transport sector consumed 27% of the total energy consumed and emitted 25% of the CO_2.

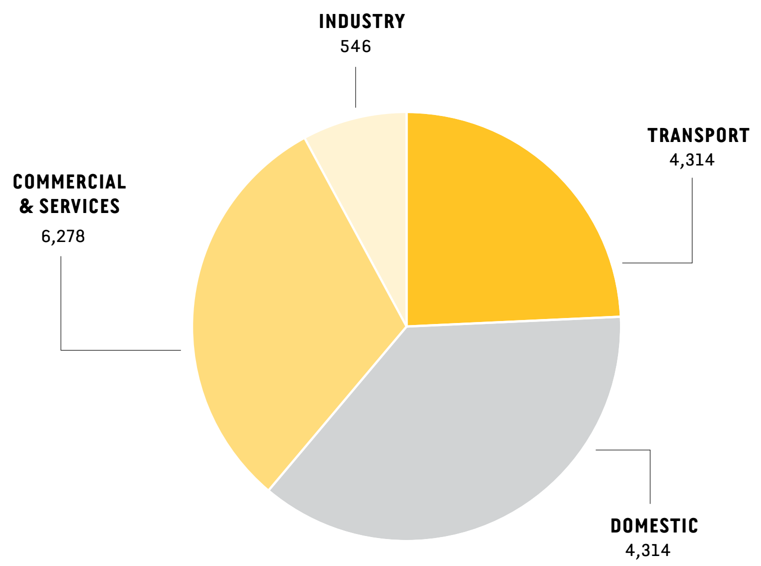
The domestic sector emits less CO_2 per unit of energy than the commercial/services, industrial or transport sectors according to data from 2005. This is primarily because the domestic sector is heavily reliant on the use of gas for space heating, domestic hot water and cooking, which currently produces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

In 2005, GM's direct CO2 emissions were a little over 18 million tonnes, decreasing by just under 4% to around 17.5 million tonnes by 2008. National datasets would suggest GM may expect a slight increase in emissions in coming years as some of the 2008 reduction can be attributed to weather and economic factors.

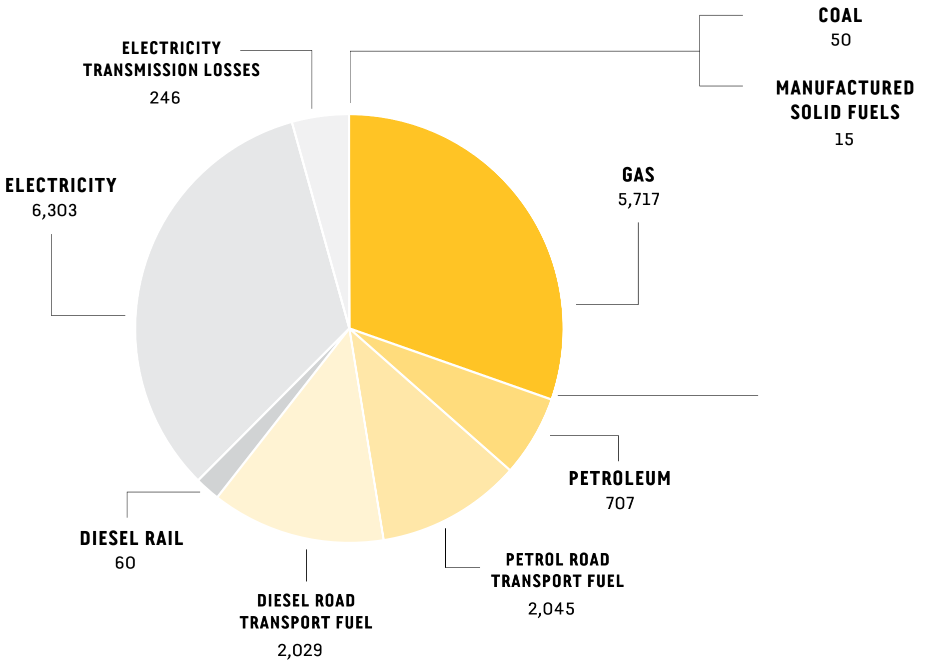
ENERGY CONSUMPTION (GWh) BY FUEL SOURCE IN GM FOR 2005



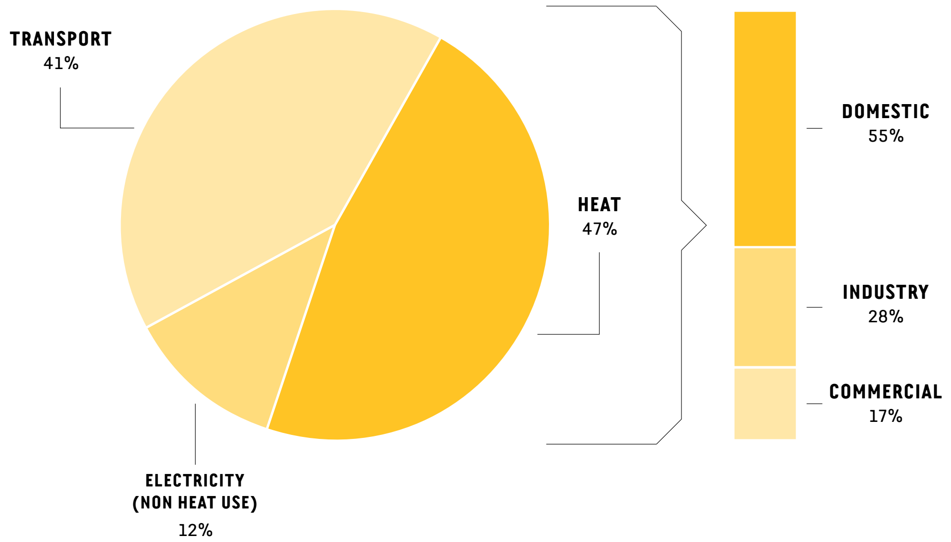
GM CO_2 EMISSIONS BY SECTOR IN 2005



CO_2 EMISSIONS ($ktCO_2$) FROM ENERGY CONSUMPTION IN GM IN 2005 BY ENERGY SOURCE

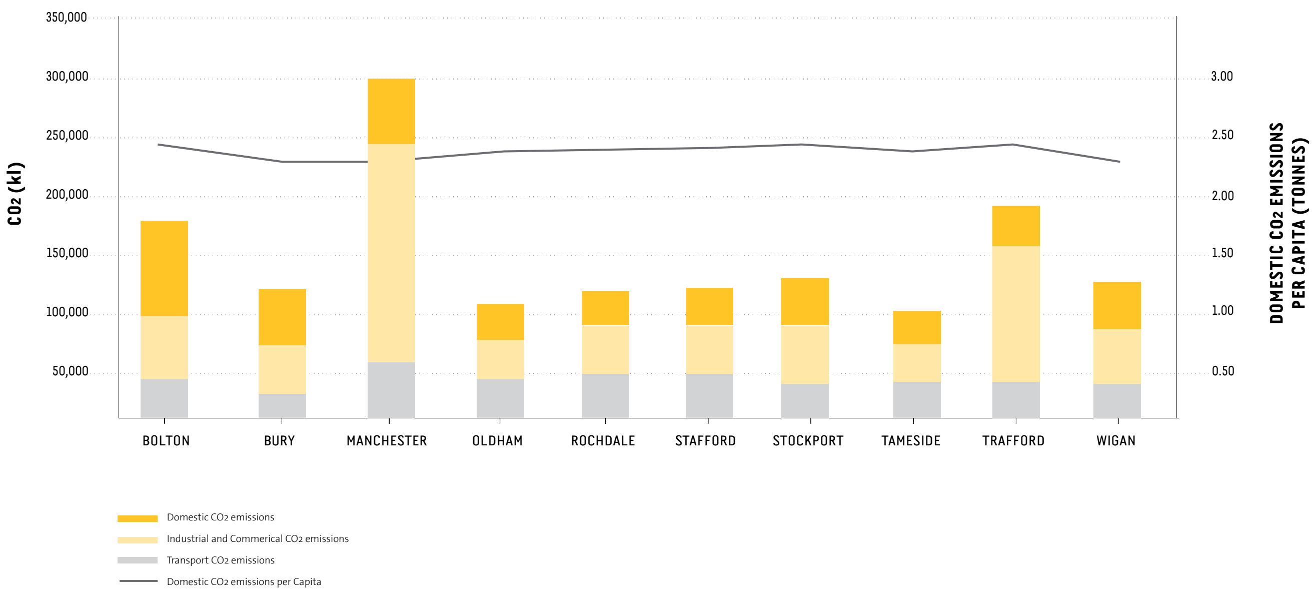


TOTAL ENERGY CONSUMPTION IN 2008



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.

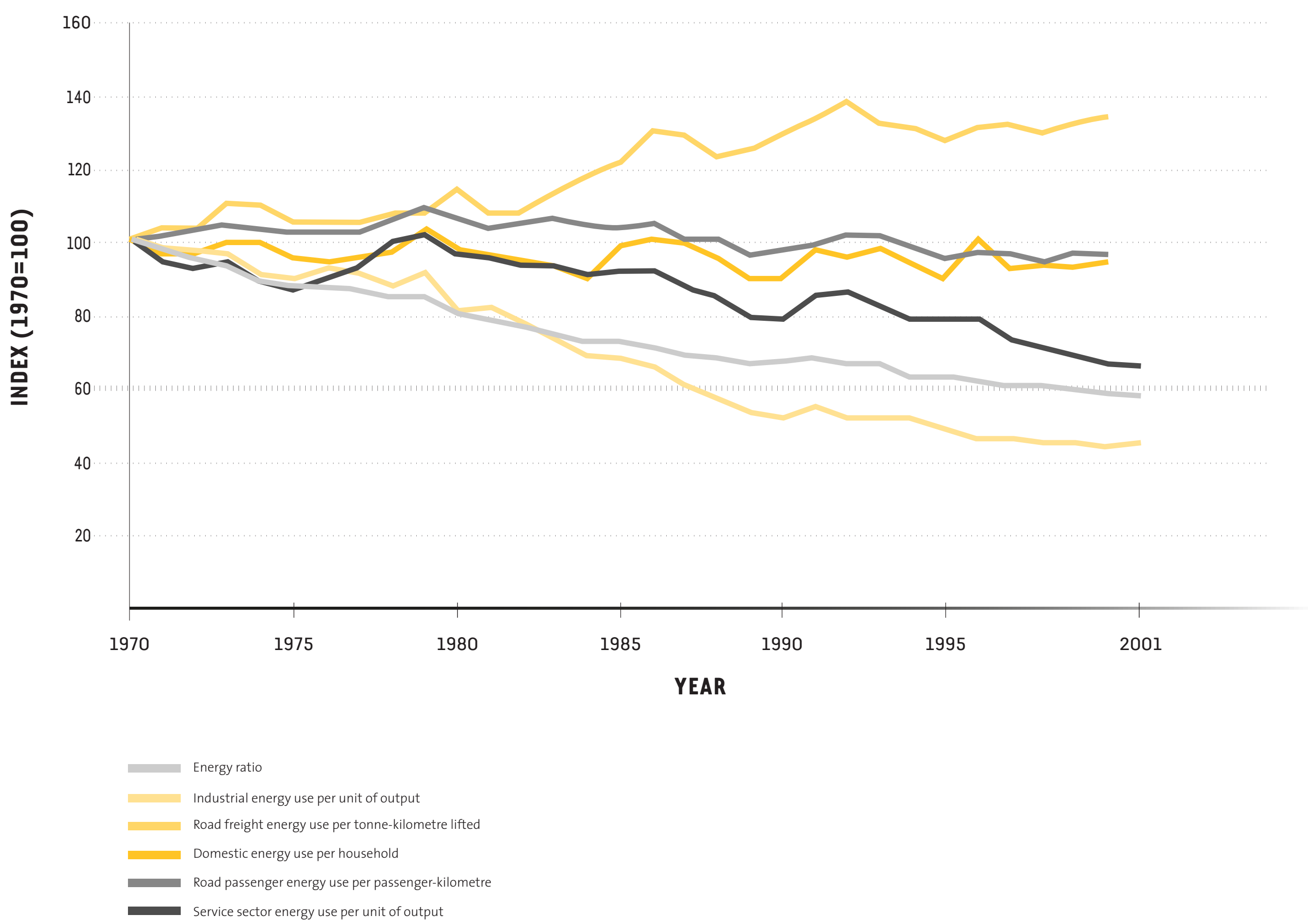


This information is primarily used to provide a 2005 baseline against which progress can be measured.

ENERGY INTENSITY

In 2010 the amount of primary energy used in the UK was just 4% more than in 1970, despite significant changes in economic output, population, car ownership and prosperity. A substantial decrease in commercial and industrial energy use has been offset by a sharp increase in transport fuel consumption. Although energy consumption has generally followed an upward trend in the UK, with any decreases generally associated with economic downturns, in most sectors, energy intensity — the amount of energy used to deliver activity — has followed a downward trend since the 1970s. According to DECC's Energy Consumption in the UK report, in 2000, energy intensity as measured against GDP was at just 57% of its 1970 level. However, there are substantial sectoral variations, most notably a significant decrease in energy used per unit output in the industrial sector, and a significant increase in the energy intensity of freight. The mix of fuels has also changed, with gas taking over from solid fuel and diesel as the primary means of providing heat and fuelling many other processes, including electricity generation.

SECTORAL ENERGY INTENSITY INDICATOR, 1970 TO 2001



1.4 **UNDERSTANDING ENERGY USE**

Access to accurate and timely information regarding energy consumption is a core challenge facing many businesses and households.

1.4.1 DOMESTIC ENERGY DATA

Most householders obtain energy consumption data from quarterly bills. Uptake of smart technologies to enhance user understanding of consumption is low, and the accuracy of bills is often poor. The UK Government is committed to improving the availability and quality of energy consumption and cost information including improvements to billing information and the installation of domestic smart meters in all homes by 2020. Many utility companies now offer devices and software to assist consumers in monitoring energy use. However, these devices are not currently connectable to the network in a way which enables the use of information to monitor area consumption or inform network capacity planning and the meters are not of sufficient quality to help householders take advantage of new innovations in energy trading to help balance grid supply and demand. There is also a risk that the smart meter data management system being established by the industry may result in barriers to trading innovation or new market entrants. Greater Manchester is operating two trials to improve the quality of energy monitoring tools and user understanding of them across business and social housing communities.

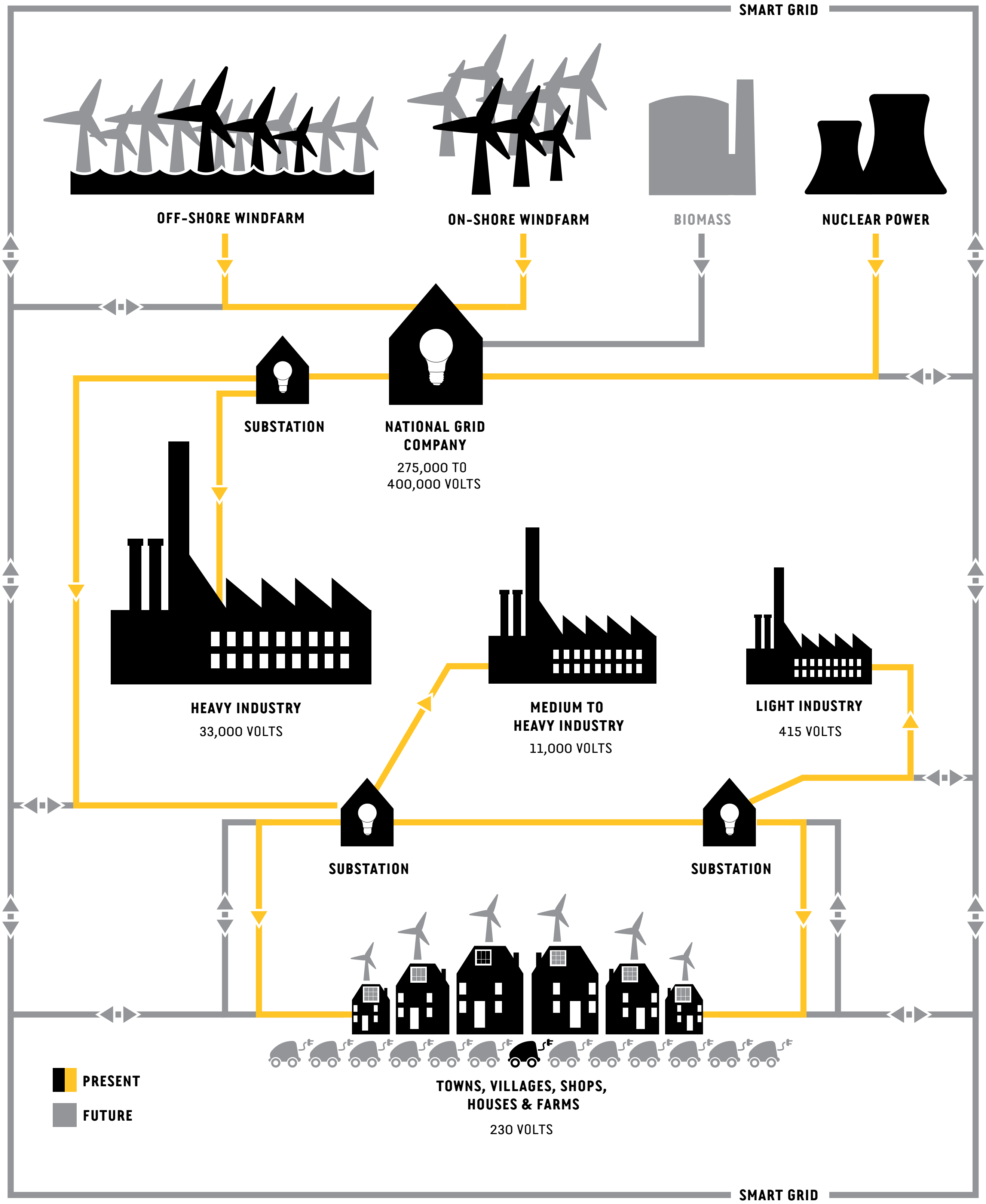
1.4.2 COMMERCIAL ENERGY DATA

There is a broad landscape of activity in the commercial sector, with some companies using half hourly meters and control software to actively monitor and manage energy consumption, with others relying on domestic scale information. Recent legislation requiring companies to disclose and pay a levy on energy consumption via the Carbon Reduction Commitment have accelerated uptake of building energy management and monitoring systems.

1.4.3 AREA-WIDE ENERGY DATA

Network information available from smart technologies has the potential to significantly increase the quality and timeliness of area wide energy consumption information, and the UK is committed to rolling out smart meters in almost every home by 2020. Until then, only national datasets derived from energy supply companies estimates of consumption are available. These datasets take around 18 months to collate, and the quality of information is often poor. By influencing market reform processes currently underway to accelerate roll out of smart meters, and change the incentives and processes for a timely collation of energy data, Greater Manchester aims to improve its understanding and ability to respond to core energy challenges.

1.5 OVERVIEW OF CURRENT AND FUTURE ENERGY SYSTEM



1.6 DRIVERS OF FUTURE CHANGE

Underpinning any future energy system is the need to continue to provide a constantly available, affordable supply.

There are three main drivers of change in the way energy is provided and used:

Reduce carbon emissions:	The UK has to meet the legally binding CO_2 emission targets of a 30% reduction in emissions by 2020 and an 80% reduction by 2050, compared to 1990. The energy system has a large contribution to make to CO_2 emission reductions as 98% of emissions are due to the burning of fossil fuels to meet energy needs. Greater Manchester has an ambitious emissions reduction target of 48% by 2020.
Meet increased demand for energy/ electricity:	Greater Manchester is planning for growth which will mean an increase in households and businesses requiring energy, which will increasingly be electricity. Currently across the North West the average demand per customer is 1.5kW, with total domestic demand across the ENW network being 3.3GW. By 2030 domestic heat pumps will add another 2.75GW and electric vehicles a further 4GW demand to the system. Even if this additional demand did not add to existing peaks (which it quite possibly would, especially in colder periods) it still represents a doubling of potential demand.
Supplies of fossil fuels:	The easy to access fossil fuels such as coal and North Sea gas, will be much diminished by 2050. New technologies will have developed to extract fuel from other sources, such as shale gas, but it is highly likely that supplies will be largely imported and much more expensive and subject to price volatility. Local supplies come with high environmental penalties and will also be expensive. There is also a direct conflict between the use of these products and climate change targets. Fossil fuels will more than likely continue to be part of the UK's energy make up but as a top up, rather than as the main source of energy. Where they are used, the CO_2 emissions will need to be abated by carbon capture and storage technologies.

WHAT CHANGE WILL LOOK LIKE NATIONALLY AND WITHIN GM

A range of approaches to achieving the CO2 reduction targets have been tested in what are called the Government's '2050 Pathways'. Each Pathway places a major emphasis on a different variable (for example demand reduction in the domestic sector or renewable electricity from off shore wind) and most scenarios can make the required CO2 savings providing 'heroic' efforts are made. A number of key messages emerged from the Pathways:

Demand reduction from individuals and businesses is the cheapest but least controllable way of achieving targets, as it relies on timely and significant voluntary action by millions of stakeholders;

There will be electrification across major sectors (e.g. transport and heating) combined with decarbonisation of generation;

Sustainable bioenergy should be part of the plan, but clear standards and an understanding of quantities available are needed;

With growing dependence on variable energy sources (e.g. wind) there will be an increasing challenge to balance supply to keep the lights on;

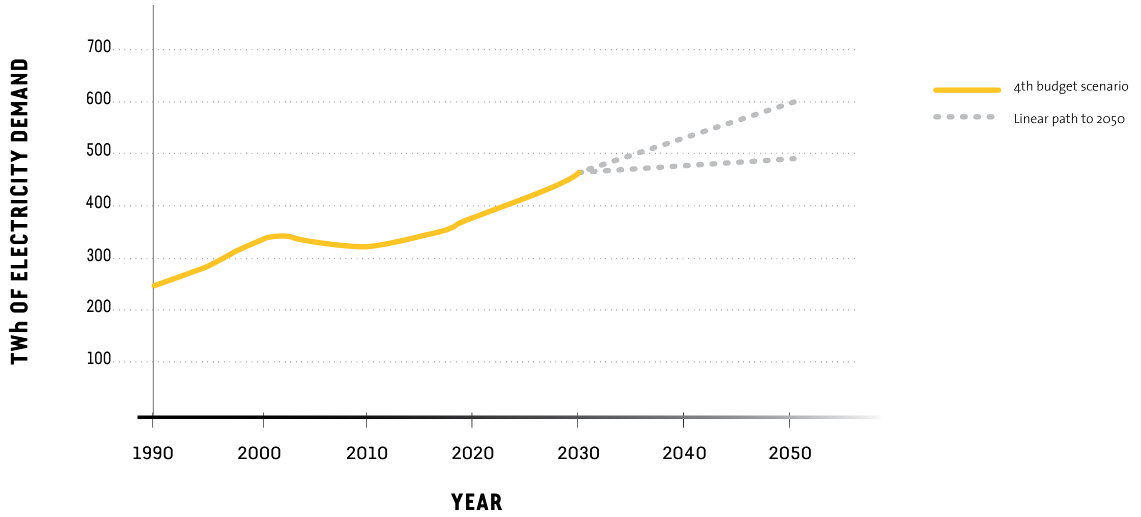
Future infrastructure and new electricity generation technologies are uncertain; and

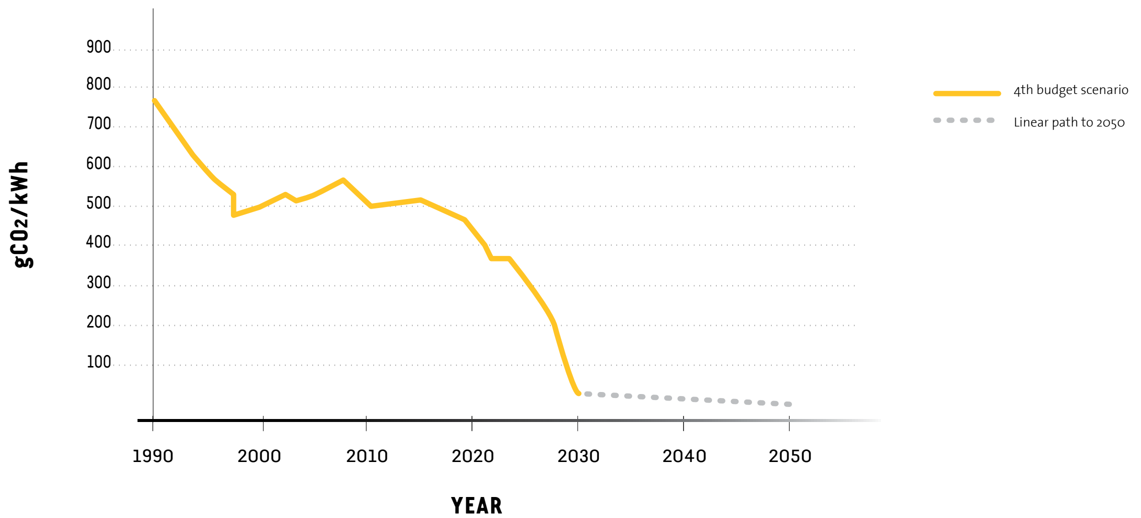
Fossil fuels will continue to have a role and the problem of the price of imports associated with this will still be a factor in 2050.

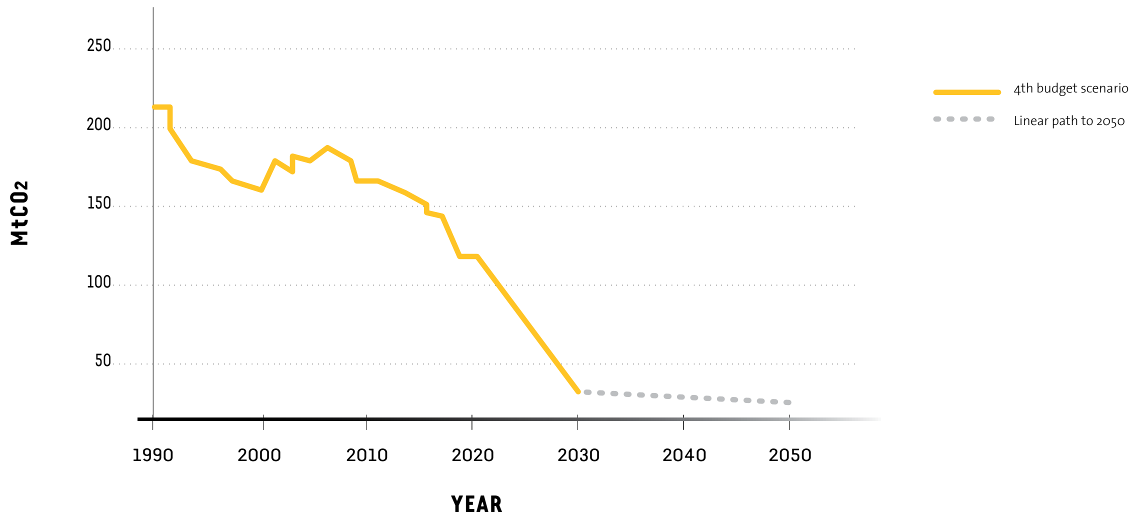
Decarbonisation of electricity will be required to achieve this change, and the Climate Change Committee's evidence suggests that there is sufficient renewable resource to achieve these ambitious targets. The estimated power requirement for 2050 is around 500-600 TWh compared to 350TWh today, and DECC have identified a potential capacity of 860TWh from renewable sources which they consider to be commercially viable over the necessary delivery period. However, this makes challenging assumptions about the rate of deployment of new infrastructure, and the willingness of communities to sanction and contribute to its delivery. In October 2011, the Committee announced a new project to examine and make recommendations about the role of areas and local government in delivering carbon reduction and energy targets. We will work with the Committee on Climate Change to develop and implement their findings during 2012.' to the end of the text.

POSSIBLE FUTURE ENERGY MIX

Advisors to government, the Climate Change Committee, have set out what the ambitious targets of the fourth Carbon Budget mean in terms of the change needed. The following charts illustrate their estimates of electricity demand, the required carbon intensity of that electricity and the resulting emissions which would meet targets to 2030, on the way to the 80% reductions required by 2050.







GM ENERGY DEMAND

Four studies have aimed to place an understanding of the national framework into a UK context; the NWDA Report, the GRIP scenarios study, and ENW's capacity planning studies.

NORTH WEST AND GREATER MANCHESTER

The NWDA's 'North West renewable and low carbon energy capacity and deployment report' (see appendix) identified that there were sufficient renewable energy resources within the north west to meet the Renewable Energy Strategy targets (30% of electricity to be from renewable sources by 2020) but that there were considerable challenges, constraints and uncertainties which might make deployment of the resources by 2020 difficult.

'Developing Future Energy Scenarios for Greater Manchester March 2010' is a report developed with stakeholders to develop ideas about energy systems which could deliver the CO_2 reductions required for Greater Manchester. Clear findings were the requirements for significant change in all areas and action at the Greater Manchester level to support national targets.

Half the world's population currently live in cities and this is projected to increase to 60% by 2025.1 Cities currently create a disproportionate share of green house gas emissions and therefore have the potential to make a big impact on reductions. GM will have to take action on demand reduction and probably to a lesser extent to generate its own renewable and low carbon electricity.

The NWDA commissioned work to look at demand and renewable capacity within the North West. This report identified sources of renewable energy across the north west, in GM much of the potential was within the dense urban form, in opportunities for cogeneration or providing demand for variable generation presented by the number of households and industries which are in close proximity.

GRIP SCENARIOS

GRIP is an energy system modelling tool endorsed by the EU Covenant of Mayors for use in municipal energy planning. Workshops held during 2010 identified the following potential solutions for GM in meeting its energy needs within its carbon reduction targets.

The main findings of the work included:

CO_2 reduction scenarios for 2050 of 87-90% can be 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% (suggesting that GM may need a greater focus on energy demand reduction than UK policy would indicate).

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

All scenarios required a significant increase in large scale and decentralised energy generation at GM level to avoid negative economic consequences.

[1] *Sustainable Urban Infrastructure London Edition - Siemens*

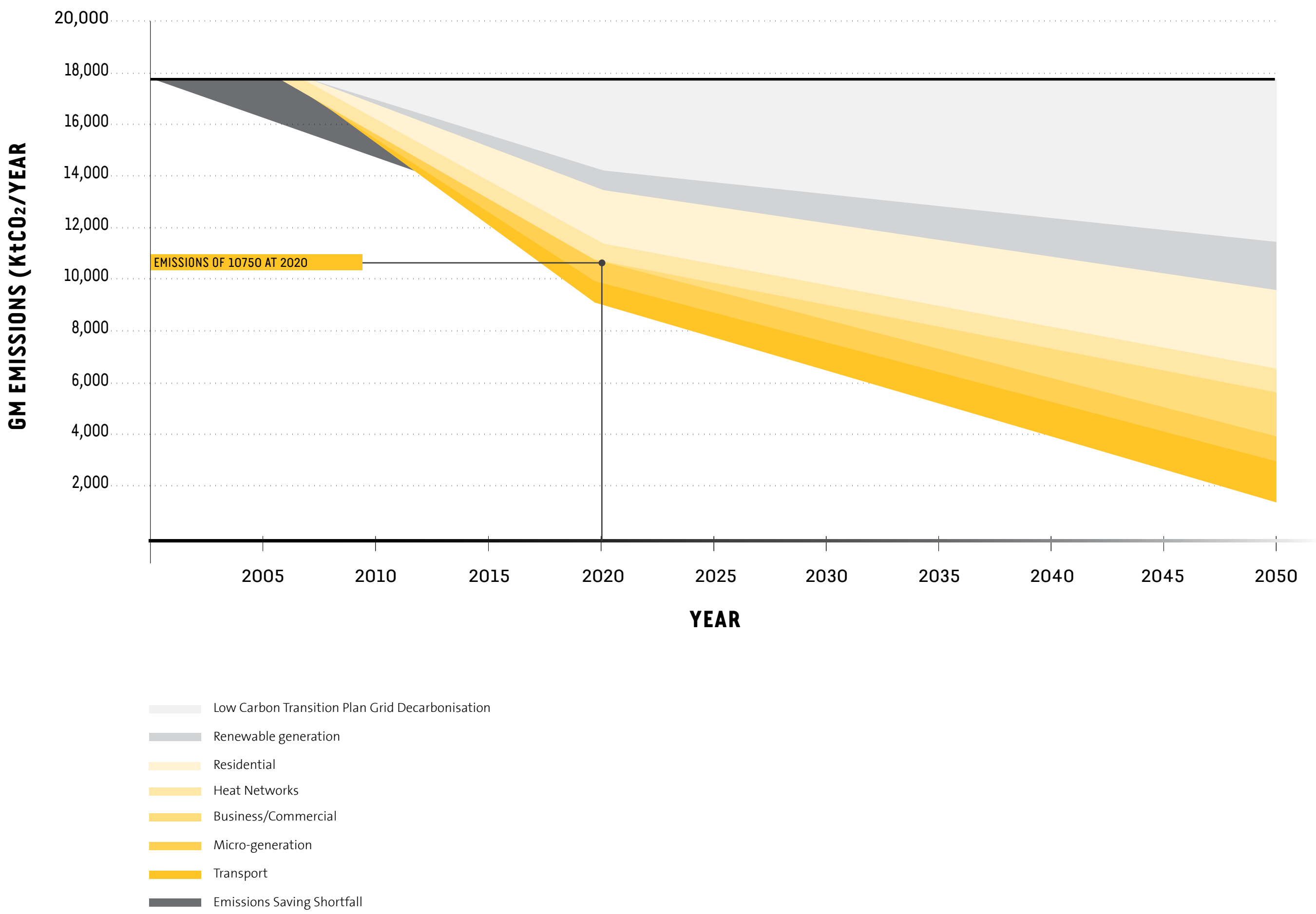
ENW CAPACITY PLANNING

The modelling system used by Electricity North West is more closely aligned to UK forecasts, suggesting a significant growth (almost doubling) of electrical demand between now and 2050. The modelling system used by ENW is highly constrained by regulatory factors, and there are a number of issues not eligible for consideration in modelling which could significantly affect the result. These include local economic forecasts, the likely impact of pipeline property development and growth, and also the contribution which a more active use of the network could make to achieving energy targets. Electricity North West are keen to develop a more locally responsive approach to capacity planning and investment, and engaged in a series of consultations and stakeholder events during 2011 to support the development of its current direction statement. This included a range of activities to encourage government to adopt a more inclusive approach to regulated capacity planning.

SEAP PROJECT

The graph below demonstrates the likely effect of national measures to decarbonise the grid, and the further actions needed at GM level, either by local uptake of international national schemes and initiatives, or via local action. It is based on work undertaken for the 2010 Sustainable Energy Action Planning Project (insert link), which developed an overview of the potential for different energy demand and supply reduction programmes within Greater Manchester.

GM CO_2 EMISSIONS TRAJECTORY LCTP SCENARIO



OUTCOME OF THE STUDIES

Both studies have limitations, and lead to different conclusions about the likely scenarios for GM's future energy consumption. The GRIP model is very focussed on cost effectiveness, and, to a certain extent, assumes the willingness and ability of all stakeholders to act in accordance with price signals and carbon targets. This leads to an emphasis on energy demand reduction to deliver results. Relatively low uptake rates of cost effective energy demand reduction technologies over the last twenty years indicate that communities capability to deliver demand reduction is weaker than the proposed scenarios might suggest.

As such, ENW intends to undertake more detailed modelling work in order to inform GM targets, the results of which can be expected in early 2012. It may also be necessary to engage with Government and OFGEM to ensure that future capacity forecasts more accurately account for local demographic and economic needs.

REDUCING ENERGY DEMAND

Cutting energy use is an important component in achieving Greater Manchester's strategic economic, climate change and social goals. Significant reductions have been achieved in the Commercial and Industrial sector and domestic retrofit programmes can already be seen in economic and emissions performance data.. As the majority of electricity and gas is consumed as part of the occupation of Buildings, energy demand reduction via a comprehensive approach to carbon reduction in the built environment is one of the 5 priority themes of the Greater Manchester Climate Change Strategy. This theme is the core focus of Greater Manchester's Low Carbon Hub's Buildings Group (see report 8).

The Greater Manchester Housing Retrofit Strategy establishes specific emissions and energy use reduction targets from our housing stock, and provides greater detail on the actions needed to reduce energy consumption in homes. It is due to be published in spring 2012.

In parallel with this work, we are active in a range of national and local initiatives to reduce the energy demand of businesses and industrial processes.

Programmes such as the award winning ENWORKS (www.enworks.com) business efficiency programme have delivered significant efficiencies, and there has been good local take up of sector and industry schemes. The Greater Manchester Chamber of Commerce operates a Carbon Reduction Group to encourage uptake of energy demand reduction measures for its businesses.

Assumptions regarding the impact of these programmes have, where practicable, been included in the scenarios and forecasts regarding future energy consumption, but significant further work is needed on future scenario planning and project evaluation to reach a level of understanding which would provide certainty that planned measures will fully deliver intended goals. As part of this, both emission reduction projects and new economic or social activities and trends which may increase energy use need to be included in analysis.

CONNECTED: REPORT 2
OUR ENERGY INFRASTRUCTURE

2.1 OVERVIEW

This section describes the energy system and outlines the components that make up the UK's current energy mix, and those that could play a new and vital role in the future.

Much of this briefing focusses on electricity rather than gas, coal or oil. Carbon reduction strategies to reduce heat demand in homes and buildings, and reduce emissions from transport are likely to shift the UK's energy mix from gas and transport fuel to electricity. This means that while overall energy demand will reduce, electricity use is likely to increase over the next twenty years.

2.2 ENERGY GENERATION

2.2.1 OVERVIEW

The UK's electricity is generated primarily by a small number of very large power stations. Oil, gas and coal are vital parts of the UK's energy mix and are used extensively for electricity generation, however to avoid dangerous climate change their CO_2 emissions need to be reduced. The UK is increasingly reliant on imports of these fuels as North Sea supplies of oil and gas are in decline. This presents possible problems for energy security in the future. To avoid dangerous climate change their CO_2 emissions need to be captured or significantly reduced. The development and deployment of Carbon Capture and Storage (CCS) is critical to this, as it has the potential to reduce the CO_2 emissions from power stations by around 90%, and make a significant contribution towards the UK and international climate change goals. However, once the costs of this and the rapid commercial improvements in renewable technologies and energy storage are integrated into the supply chain, there is a significant possibility that a diversified renewable supply will be more economically attractive to the UK than continued reliance on fossil fuels.

Around 18% of the electricity generated in the UK comes from nuclear power stations and the government's Low-Carbon Transition Plan published in July 2009 confirmed that new nuclear power has a key role to play in the UK's low-carbon future, although recent tragic events in Japan may have set this back. Around 5.3% of UK electricity is generated from renewables, such as wind and solar power. To reduce its reliance on fossil fuels the UK needs to increase the proportion of its energy which comes from renewable sources. Offshore wind is one of the best natural resources in Europe, and the UK already leads the world in offshore wind farms. The UK also leads in several developing technology areas like wave and tidal energy, given the excellent natural resources.

The range of sources needs to be as diverse as possible to ensure secure supplies – as wind and solar energy are weather dependent – and will include biomass used as a fuel and ground source energy.

Distributed or decentralised energy is the supply of low carbon or renewable electricity and heat, to customers of all scales including domestic or industrial, and is generated on or relatively near the site where it is used. It includes combined heat and power (CHP), small scale and micro hydropower, micro and small wind turbines, photovoltaics (solar PV), biomass and district heating as a means of transporting renewable or low carbon heat to multiple consumers.

It is clear that diversifying the mix of energy in the UK supply is critical to the UK meeting CO_2 reduction targets but it is highly dependent on technological advances and the uptake of these new technologies by suppliers and consumers.

Electricity generation and transmission makes inefficient use of primary energy sources, with some coal fired power stations only providing 30% efficiency, the rest of the energy being lost as heat or other process losses.

There are currently very few opportunities to store electricity, so generation has to match demand, which varies over the day and the year. Not all generation can be boosted on demand so it is important to have a mix of supplies in the energy system.

There are essentially three types of generation:

Generation through natural occurrences – for example wind and sun, which are intermittent;

Generation through coal and nuclear which tend to create a steady output that cannot easily be adjusted to match demand;

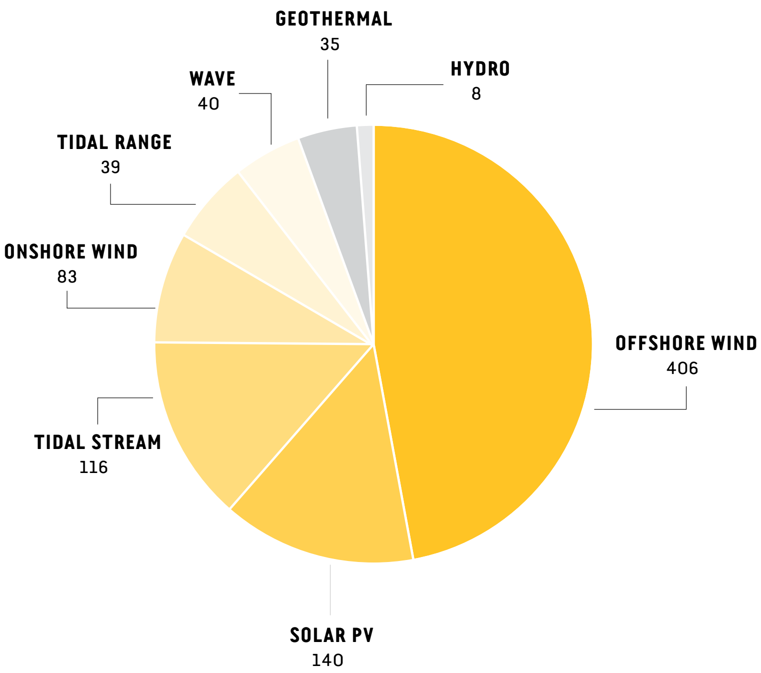
Generation through gas or other fuels which can be quickly adjusted to match variation in demand.

These concepts are important to understanding how GM can start to influence its own energy future using decentralised supply.

2.2.2 HOW MUCH POWER DOES GM NEED?

Greater Manchester currently uses around 60TWh of energy each year, and by 2050, for reasons explored further below, it can be expected that the majority of energy demand will be for electricity. The estimated UK power requirement for 2050 is around 500-600 TWh compared to 350TWh today, and in the absence of other evidence, it seems reasonable to assume that GM's requirements will increase by a similar proportion. Set against this, DECC have identified a potential capacity of 860TWh within renewable sources which they consider to be commercially viable over the necessary delivery period.

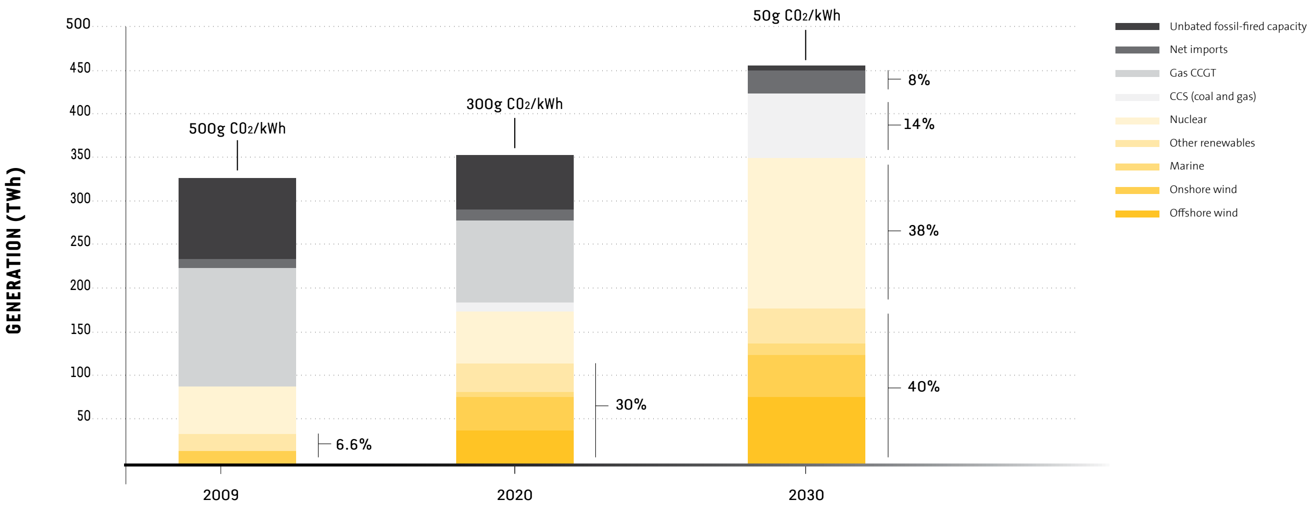
UK RENEWABLES CAPACITY GW



There is uncertainty about the future of each technology and the cost effectiveness of delivering them so the government is currently putting in place a range of legislation which generates fiscal stimulus to a number of different technologies..

Policies are already in place to stimulate some of the necessary markets such as the Green Deal, Smart metering, the Renewable Heat Incentive and Electric Vehicles.

The Committee for Climate change present one possible scenario for the 2030 mix of energy sources which is 40% renewables and 38% nuclear.



Source: DUKES (2010) CCC Calculations, based on modelling by Pöyry Management Consulting. Includes losses, excludes generator own-use and autogeneration.

This scenario illustrates the significant change needed to electricity generation. For the objective to be achieved, the carbon intensity of energy production has to fall to 10% of 2009 levels, there needs to be a 9 fold increase in renewable energy sources, and a dramatic growth in nuclear power is also needed, at a time when recent events have made the issue of new nuclear installations more controversial than ever.

2.2.3 MEETING DEMAND

The UK faces a serious challenge in meeting electricity demand over the current decade. There is a mismatch between the decommissioning of old, inefficient plant which is nearing the end of its useful life, and the pipeline for delivering new energy schemes to meet the gap. More than a quarter of the UK's generating capacity is due to shut down in the next ten years, and the delivery of the cc 20 new power stations and thousands of renewable energy schemes to meet the gap will require around £110 Billion in investment.

To address this, the UK government recently announced the following measures:

Key elements of the reform package include:

The announcement in Budget 2011 that the Government would put in place a Carbon Price Floor to reduce investor uncertainty, putting a fair price on carbon and providing a stronger incentive to invest in low-carbon generation now;

The introduction of new long-term contracts (Feed-in Tariff with Contracts for Difference) to provide stable financial incentives to invest in all forms of low-carbon electricity generation. A contract for difference approach has been chosen over a less cost-effective premium feed-in-tariff;

An Emissions Performance Standard (EPS) set at 450g CO_2/kWh to reinforce the requirement that no new coal-fired power stations are built without CCS, but also to ensure necessary investment in gas can take place; and

A Capacity Mechanism, including demand response as well as generation, which is needed to ensure future security of electricity supply. We are seeking further views on the type of mechanism required and will report on this around the turn of the year.

Alongside this, measures to strengthen interconnectivity with European generation are underway, as being able to amortise demand and supply across a larger geographical area is viewed as a positive way to help balance system demand and supply. While this may strengthen energy security, it also has implications for the cost of supplied power, and could leave the UK vulnerable to power shortages caused by difficulties experienced in other European countries. It also has implications for the carbon and wider environmental and economic footprint of supplied energy, and the UK's ability to control it.

2.2.4 GM'S GENERATION ASSETS

GM has relatively little exposure to electricity generation. Its current significant assets include:

Scout Moor Windfarm, on the border of Bury, Rochdale and Rossendale. This produces around 142.5GWh of electricity per year, equivalent to around 1.2% of GM's total annual electricity usage. A proposal to increase its size by up to double is under consideration, and this would increase its contribution to around 2.5% of GM's electricity usage. The development produces electricity at a lower than average cost per unit for UK renewable supplies, and the CO_2 emissions associated with the site are minimal.

Hydro power schemes in Stockport and on the Manchester Ship Canal.

There are also a significant number of small scale generation projects to provide energy to a single site user or private, networked community. A snapshot of these is provided in the diagram below.

Four landfill and other energy from waste schemes producing a combined total of up to 300MWh of electricity per year.

Assets currently in the process of being delivered include:

Carrington power station: A new gas fired power station is currently under construction at Carrington, Trafford. By 2015, the new facility is expected to produce between 3 and 6TWh of electricity per year. This is equivalent to between 25% and 50% of GM's total annual electricity usage, depending on its final output which may vary according to market conditions. The plant is expected to operate at around 50-60% efficiency, with annual CO_2 emissions of between 1 and 2 million tonnes, (this assumes that carbon capture and storage facilities are not retrofitted to the proposed plant). A further plant is being considered for the same site, with around half the power output of the Carrington station. However this is unlikely to be fully operational until much later in the decade and is currently in early planning stages.

Greater Manchester Waste Disposal Authority is putting in place infrastructure across the region, using Greater Manchester's waste to power four groundbreaking anaerobic digestion plants and a combined heat and power scheme to produce 8MW of electricity, 83MW electricity and 5MW heat respectively.

Barton Renewable Energy Plant: A new 20MW biomass plant (around 1% of GM's power usage) is in the planning process with a decision expected from Trafford Council towards the end of 2011. If consented it could be operational by 2014.

2.3 **LOW CARBON AND RENEWABLE GENERATION TECHNOLOGIES**

2.3.1 LOW CARBON FUELS AND TECHNOLOGIES

A snapshot of the significant and growing range of renewable and low carbon technologies, is provided below. The DECC website (www.gov.uk/decc) provides much greater detail.

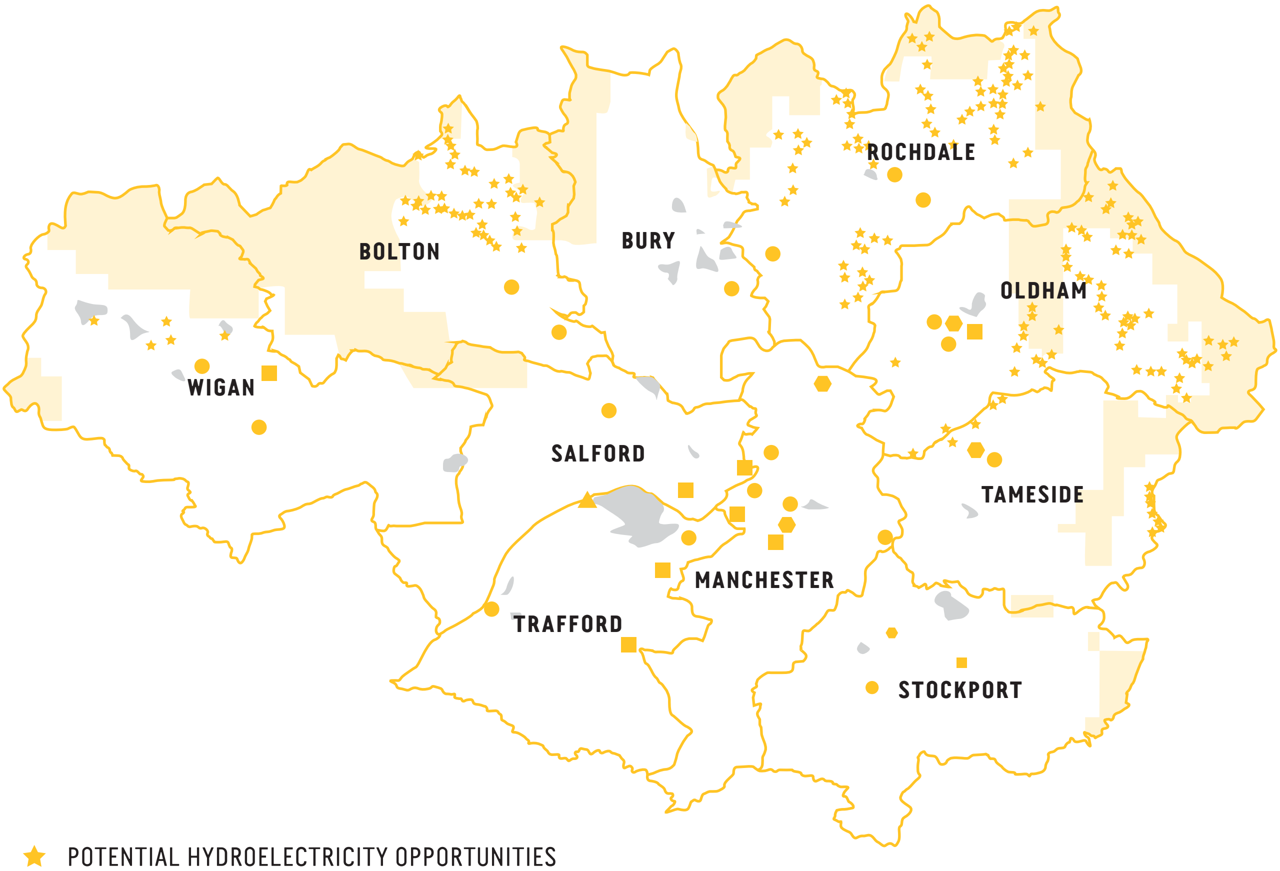
Combined Heat and Power (CHP) technologies	Use conventional fuels like gas or lower carbon biomass or waste derived fuels to produce both power and heat. Even the most efficient combined cycle gas turbine power stations capture less than half of the gas's energy as usable electricity. CHP produces electricity but also captures the heat generated by the process, meaning that in the best cases, as much as 90% of the fuel's potential energy can be used. There are already many applications of this in Greater Manchester, and a further extension to use CO2 rich gases released by the processes for horticultural or brewing applications can further extract value from the use of burnable fuels. CHPs can act as the anchor for small, mid or large scale heat networks, or provide a single site, such as a school. Although trials of domestic-scale CHP have taken place, capital and maintenance costs currently mean they are not cost competitive with standard boilers.
Hydrogen Fuel Cells and related technologies	Can either turn conventional gas products into hydrogen more cleanly than direct burning, then use the resulting hydrogen as fuel, or use hydrogen produced conventionally from water using clean electricity sources. This technology has significant potential both as a transition technology as we move from directly burning fossil fuels, and as a longer term technology as a means of storing energy produced from intermittent renewable sources (see below) as hydrogen. Small scale hydrogen fuel cells are being trialled at domestic and building scale across the UK. Greater Manchester would benefit from a more coherent approach to linking up existing areas of research and knowledge, in order to benefit from this developing market.
Nuclear energy	Uses fission to release energy at atomic level. It is regarded as a low carbon technology, and has provided an important component of the UK's base electricity generation for many decades. Existing plants are now reaching the end of their life and the costs and benefits of building new stations are widely debated. Although nuclear energy does not release carbon dioxide as a direct result of its processes, the indirect resource use, as well as wider societal risks, interdependencies with weapon production processes and the challenges of long term waste storage and processes make it a highly controversial technology. For these reasons, some GM authorities have policies in place which seek to eliminate nuclear energy from the UK energy supply chain and to preclude its location within authority borders. The University of Manchester hosts world-renowned research into nuclear energy production and waste treatment.

2.3.2 RENEWABLE ENERGY SOURCES AND TECHNOLOGIES

Solar energy	Can be captured in two ways: **Photovoltaic panels** use a catalytic process on the surface of solar photovoltaic cells to produce electricity. Although currently still entailing long payback periods **Thermal panels** use liquids in tubes to accumulate heat, which is then usually used directly.
Geothermal energy	Available in many areas of the UK, including GM. **Near Surface** geothermal uses a network of horizontal pipes, or a smaller number of vertical pipes to extract low levels of heat from the ground. **Deep Geothermal** involves drilling deep underground to access much higher temperatures, either through extraction of underground pressurised hot water, or via injecting water underground. This can be combined with steam turbines to produce power and heat. There is a commercial overlap between deep geothermal and shale gas as a very similar exploratory process is used to identify their potential. This may lead to authorities granting applications for deep geothermal exploration from companies who then seek to migrate the eventual permission for the drilled well from heat to gas extraction for commercial or viability reasons.
Wind energy	Highly flexible, with the UK having one of the best wind resources in Europe. The UK is scheduled to become Europe's largest wind power producer within the next five years, with offshore, onshore and small scale wind turbine technologies all available. Wind power can be the cheapest form of energy in the UK, however to form a large part of the energy mix it would need to be combined with storage or phase transfer technologies such as hydrogen fuel cells. GM has an important and growing wind sector, which has the potential to grow significantly and England's largest onshore windfarm at Scout Moor is on GM's northern border area.
Wave and Tidal energy	Uses the power of water movement to produce electricity. This has significant UK potential, though not directly within GM, and substantial research and breakthroughs have been made in this important source at the University of Manchester.
Heat technologies	In addition to the low carbon and renewable fuels above which can be burned or used to produce heat and power, there are a number of heat-specific technologies which are likely to form part of GM's energy future:

Heat pumps	These can extract small amounts of heat found in air, water or soil, and accumulate the heat, using a small amount of electricity. These are useful sources of heat in well insulated homes, and combine very well with under-floor heat distribution, **Ground source** heat pumps are suitable for new build properties, and in rural areas. **Air source** heat pumps could be very important in areas which are not suitable for heat networks In both cases, access to cheap electricity is required, so combining their deployment with solar PV panels and / or innovative tariffs which make use of times when grid demand is low may be important for future viability.
Hydroelectric energy	Been part of the UK's energy system for many decades **Hydroelectric storage** pumps water uphill using cheap off peak or surplus grid electricity, to then release it during peak periods. **Hydroelectric generation** uses water with a natural fall or flow to produce electricity Although it is likely that substantial resources of small scale hydroelectric power exist in Greater Manchester, further work is needed to map and assess their feasibility.

GREATER MANCHESTER ENERGY OPPORTUNITIES



- POTENTIAL HYDROELECTRICITY OPPORTUNITIES
- HYDROELECTRIC STATION
- ERDF SCHEME
- RGF HOUSING SCHEMES
- LCEA OPPORTUNITIES
- POTENTIAL ENERGY FROM WASTE OPPORTUNITIES
- AREAS OF HIGH WIND SPEED
- GM DISTRICT BOUNDARIES

FURTHER OPPORTUNITIES FOR ENERGY GENERATION WITHIN GM

The map shows a list of energy generation opportunities currently identified across Greater Manchester, including those areas where high wind speeds indicate a potential, subject to further feasibility work, of wind energy generation. Note that due to their commercially sensitive nature, specific potential wind or geothermal schemes have not been identified on the map.

A project pipeline is currently being developed to secure investment in energy opportunities.

THE GENERATION GAP

There appears to be an increasing time delay between the decommissioning of old energy generating plants and the deployment of new generation infrastructure, with assumptions regarding the rate at which wind, nuclear and new gas installation would occur having been overoptimistic. This presents the UK with a possible gap between demand and supply, particularly for the 2015-20 time period.

A number of factors are affecting deployment of new diverse generation technologies. These include:

A dominance of large companies with significant fossil fuel generation assets, which act as a disincentive to encourage or support diversification. Many assets, including skills bases, infrastructure and R&D are not readily transferable to a low carbon economy;

A range of market access constraints for new market entrants (see report on Regulatory and policy framework); and

A lack of community awareness regarding energy generation challenges and options, leading to a high rate of planning application refusals for renewable energy

These will need to be overcome if we are to achieve a secure, low carbon energy system. While it is not clear at this stage what the UK will do to address this, there are some sensible steps that Greater Manchester can take to lessen the impact in advance. These include:

Reducing the heat and energy demand of homes and businesses, by retrofitting energy saving technologies and microgeneration, and preferentially procuring low energy devices.

Raising awareness of the importance of timing energy use to match periods when abundant supplies are available. At a business level, this may mean running certain automated processes overnight, or timing use of intermittent devices to avoid peaks in general demand.

Harnessing and delivering on key opportunities to generate local electricity and heat, including large scale schemes and building integrated solar, biomass and other renewable energy technologies

2.4 **ELECTRICITY DISTRIBUTION**

2.4.1 OVERVIEW

Electricity distribution is the business of getting the right amount of power to the right place at the right time. Electricity is generally transmitted from power stations down the high voltage power cables of the National Grid to regional Distribution Network Operators who transmit low voltage supply to customers.

Electricity North West owns and maintains the network for Greater Manchester. Some of GM's network is now over 40 years old, and the network is subject to a rolling programme of reinforcement and replacement.

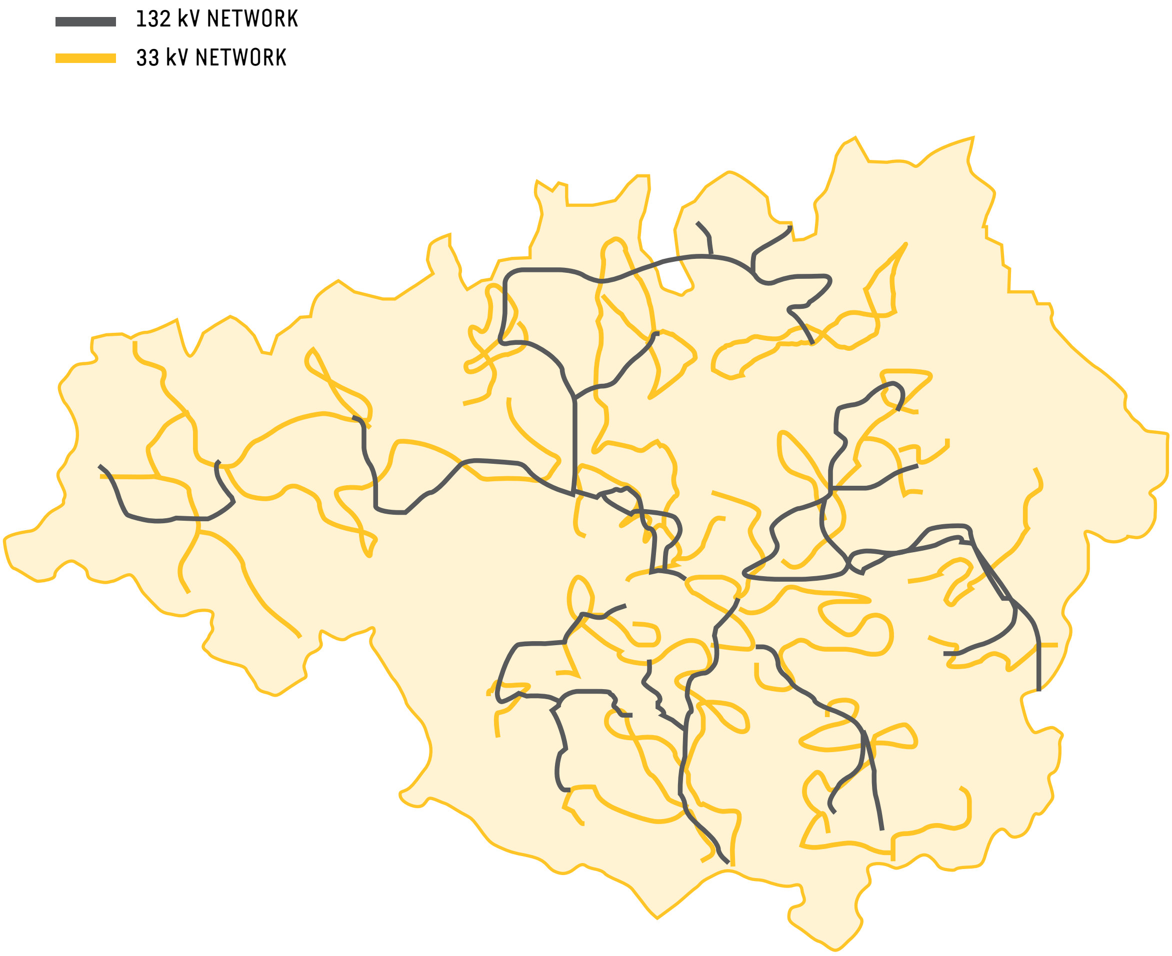
Reinforcement is put in place when it has been identified that the general growth in use of electricity is such that the network has to be supplemented to ensure adequate capacity. Replacement ensures that poor condition assets are replaced just before their performance deteriorates or fails. The network can also be subject to damage from external sources, and a programme of reactive maintenance is also in place to deal with this.

ENW have a £1.4bn investment plan for the period 2010 – 2015. The network is at capacity in some places and ENW have an investment programme to cater for increases in demand and new connections. The key investments ENW intends to make over the next decade are summarised in the Action Plan.

2.4.2 THE ELECTRICITY NETWORK

The following maps shows the high and low voltage circuits in Greater Manchester, and the location of key substations.

GREATER MANCHESTER ELECTRICITY NETWORK



The transmission infrastructure is also vital to managing demand and avoiding power shortages at peak times — storage systems and 'smart appliances' which switch on at off peak times are parts of a future energy system.

The costs of maintaining the distribution infrastructure are regulated, and are recovered from customers via a charge or levy on electricity bills, usually less than a quarter of overall costs.

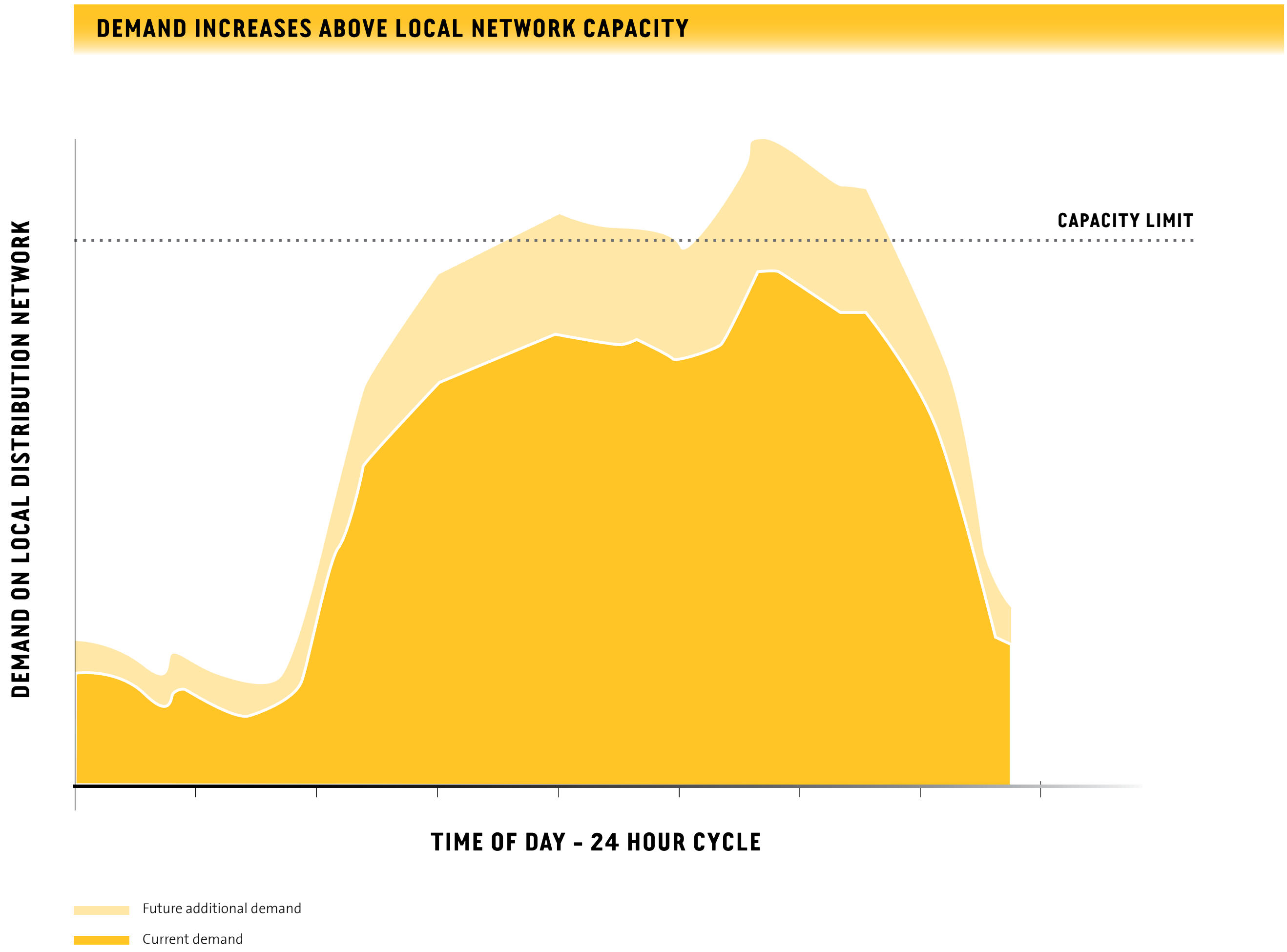
Where appropriate capacity and facilities do not exist, developers are often expected to meet the costs of new distribution infrastructure, and these costs can have a significant impact on the location and viability of proposed developments. This can, in some cases, act as a deterrent or barrier to development in locations otherwise considered optimum from socioeconomic or environmental perspectives.

2.4.3 MEETING DEMAND

Demand for energy is not constant. There are peaks of demand as people get up and in the evening and troughs in demand during the night. Variations in weather, events and activities also cause changes in demand. At the moment, balancing supply and demand is managed by the National Grid and power stations boost supply at peak times (gas is a particularly useful fuel to do this). A mix of energy sources is therefore critical to keeping a secure supply.

GM's existing network does not have the capacity to carry the increased loads which are forecast as a result of the electrification of heat production and transportation combined with growth. Reinforcement and replacement will be required.

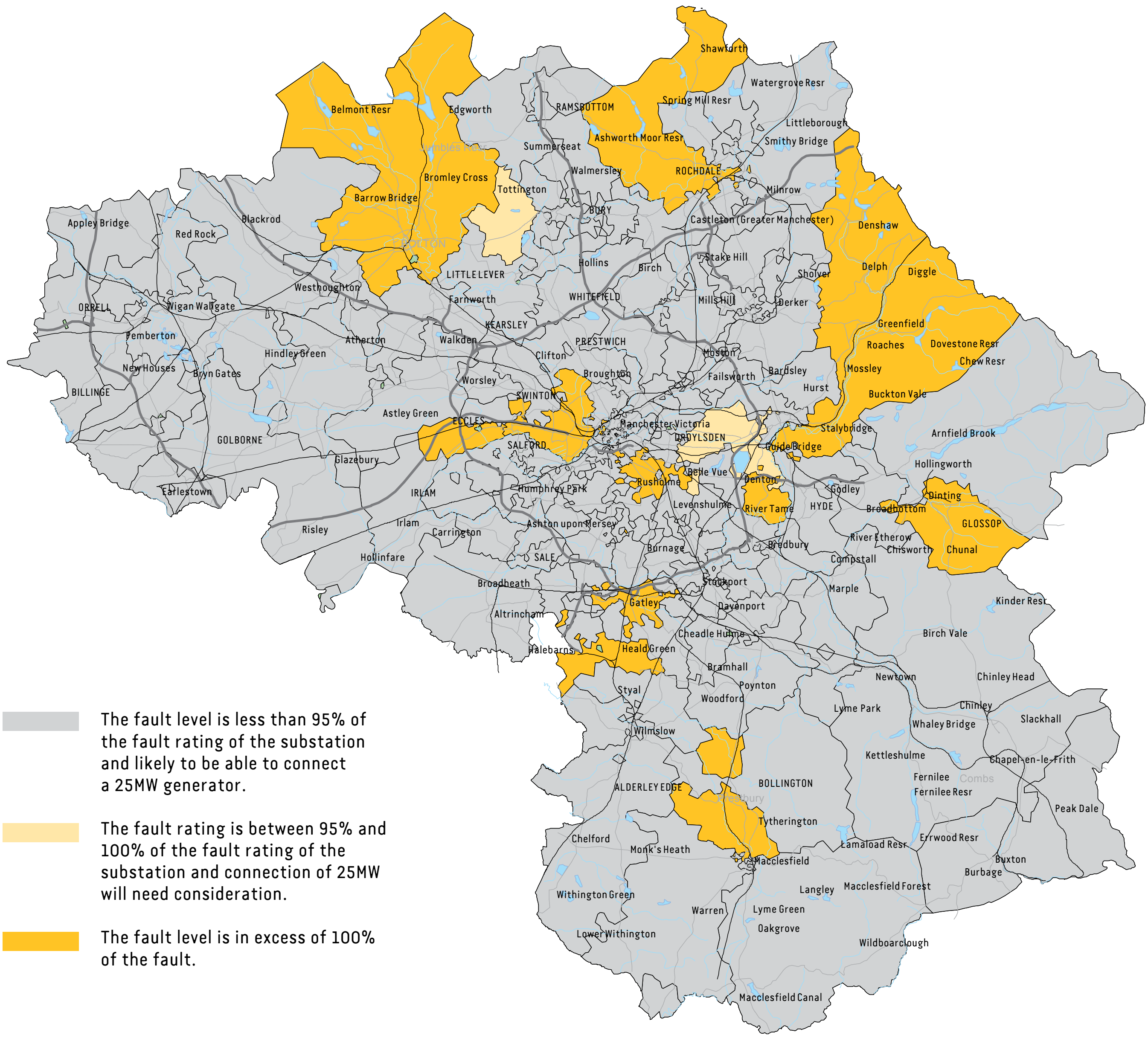
This diagram illustrates the problem at peak times.



In addition to this, the connection of new development, adoption of new technologies and other increases in electricity demand are not spread evenly across existing infrastructure, leading to challenges associated at localised points in the distribution network.

A map showing areas of capacity surplus and shortage across GM demonstrates the need to continue to invest in GM's energy network, but is also a useful resource to inform work to identify ways to avoid the high investment and disruption costs associated with reinforcement by using our existing network more innovatively.

Similarly, the network has a limited capacity for the connection of new energy generation, meaning that it is cheaper, easier and more desirable to connect new generation in specific areas. The following map uses a 'red, amber, green' coding to help inform decisionmaking regarding new connections.

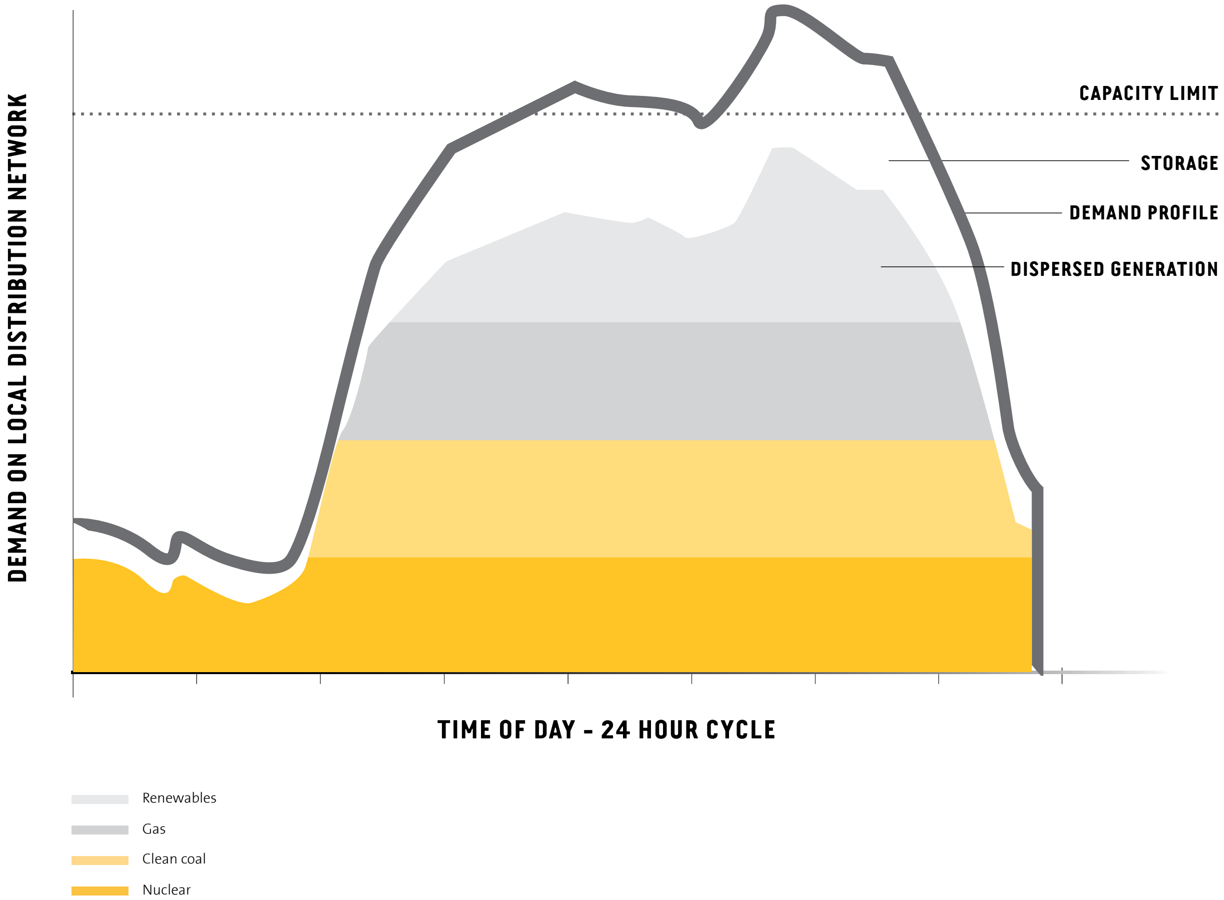


2.4.4 SECURITY OF SUPPLY

Increasing the proportion of renewable energy in the supply makes it less susceptible to price hikes as fossil fuels become less available but more susceptible to power outages, for example during a very still January when wind and solar power input is low but demands for heat and lighting are high. The following diagram shows the demand profile peaking during the day and not being met by supply – the ‘gap’ in this scenario could potentially be met by either previously stored electricity, local generation or reducing the peak demand via customer response.

This diagram illustrates the problem of increased demand and more variable generation which produces a gap, the challenge is to fill this gap with affordable supply.

HOW DO WE ENSURE THE LIGHTS STAY ON IN 2030?



2.4.5 POSSIBLE SOLUTIONS AND WHAT THIS MIGHT MEAN FOR GM

The two main priorities to meet this gap are to reduce and manage demand and to increase local generation so that local areas are less dependent on the national grid supply.

Demand management	Managing demand better means directing calls on the grid towards off peak times where possible. This could be done through more flexible pricing structures and smarter technology which can either store electricity or simply not use electricity at peak times – for example with storage heaters or freezers which do not need 24 hour constant supply. This will require systems and appliances which integrate information and communications technologies with electricity distribution. These technologies are collectively called a 'Smart Grid'. As a first step towards Smart Grid technology the Government has announced that a programme of installing Smart meters will start in early 2014 and complete in 2020. Smart meters will enable customers to be more aware of electricity usage, and will allow supply companies to have more accurate understanding of energy usage.
Grid Reinforcement standards	The electricity network is currently managed in a very strictly regulated market environment. This means that specific requirements for voltage regulation, reinforcement and other matters are specified nationally. Some of these standards have not been updated for many decades, and ENW estimates that at least a third of capacity could be released from the system through more innovative and active management of network capacity based on a more modern interpretation of the system capabilities of the network .

2.4.6 SMARTGRIDS: A LOW CARBON TRANSMISSION SYSTEM

The current distribution system is designed for a one way flow of electricity from big generators, via the national grid, to local networks. The primary responsibility for ensuring enough power is generated to meet demand rests with National Grid. The shift from a model of large power stations to lots of small generators, including wind, solar and other opportunities presents challenges to the network.

To meet these challenges, solutions need to be found to:

Connect generation sources, not just users, to local distribution networks, resulting in a 2 way flow of electricity;

Managing that 2 way flow to ensure that capacity balances supply;

Ensuring that generators and users have timely access to information regarding generation and consumption

Getting more out of the network we already have, to avoid a transition to electrified heat and transport resulting in unaffordably high network reinforcement costs.

The term ‘smart grid’ was coined to describe the type of network that can cope with these challenges, and both the UK and EU have long term programmes in place to support and accelerate their development.

Smart grids are important because they provide the potential to directly connect consumers with information and resources to allow them to match and change their own energy use and generation (e.g. from solar PV panels) with national grid energy availability.

For example, in future years a household could charge its electric car overnight from cheap grid energy, time switching on washers or the cooling cycle of freezers to use solar PV energy when the roof panels are at their peak, and have smart controls in place that mean many of these actions would happen automatically.

This would mean that fewer large power stations and less network capacity would be needed, reducing the overall costs of the energy system substantially. For it to be achieved, significant changes in how energy is traded are needed, and a range of new market entrants across the energy system will need access to highly detailed energy data which is currently specified and controlled primarily by energy retailers.

2010-2020
LAYING THE FOUNDATIONS

Smart meters and feed-in-tariffs.
DG penetration under connect and manage philosophy.
Intermittent offshore wind generation.
Trials and demonstrations of smart grids.

2020-2030
LOCAL BALANCING

Half hourly price signals.
Demand Side Response (DSR) enabled.
Inflexible nuclear base load.

2030-2040
INCREASE CAPACITY FOR ELECTRIC VEHICLES

Further DSR from storage.

2040-2050
INCREASE CAPACITY FOR DECARBONISED HEAT

2.4.7 C2C: AN INNOVATIVE SOLUTION TO GM'S ENERGY CAPACITY CHALLENGES

The Low Carbon Networks Fund (LCNF) was established by Ofgem as part of the electricity distribution price control arrangements that run from 1st April 2010 to 31st March 2015 with a view to helping facilitate the above transition.

Electricity North West has submitted an innovative proposals which seeks to tackle the challenge of providing more capacity in the high voltage network at a minimal cost and in a timely fashion while helping to keep the Government's low carbon economy ambitions on track.

The UK and other western countries networks are designed with almost 100% 'latent capacity' or 'redundancy' built into the system, so that if there is a fault on one part of the network, some of the customers affected can be supplied via a different piece of equipment or network configuration, minimising the impact and maintaining a high level of quality of supply. This is similar to all the traffic using one half of the motorway, leaving the other half free in case a problem or blockage occurs.

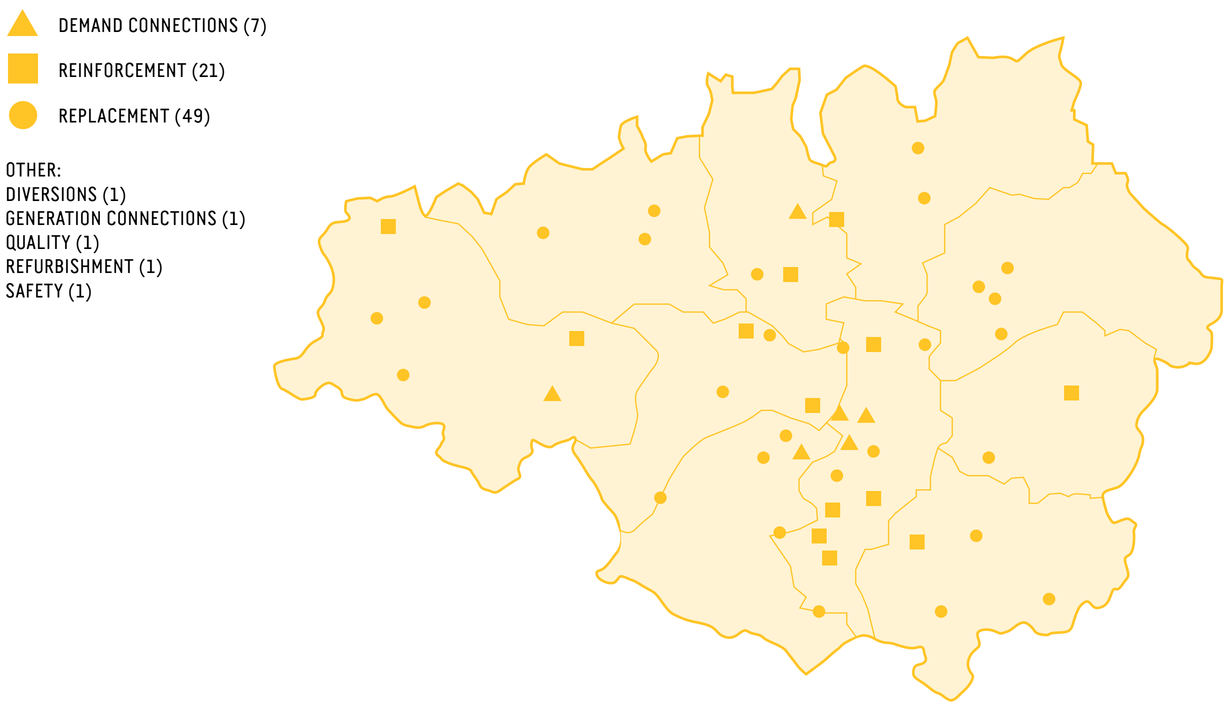
ENW would like to test an alternative approach to maintaining by the innovative application of automatic controls developed by Electricity North West, combined with the purchase of demand/ generation side response from new or existing customers (i.e. prearranged agreements for specific custimers to reduce their load in times of network stress in return for financial rewards). Early projects are already underway in Stockport and elsewhere in the North West.

The “latent capacity” that could be released is likely to be between 50% and 100% of the existing high voltage network capacity. The network configuration changes required to release this capacity are also likely to enable improved power quality and reduced electrical losses, and these benefits will also be tested and explored in this Electricity North West project. Should the trial be successful, this could release £ billions of funding that would otherwise need to be invested in network reinforcement. Other potential benefits of the scheme include opportunities to significantly decrease the cost and time requirements of connecting new low carbon and decentralised energy technologies to the grid, allowing new generation to be connected where it’s really needed, instead of where it’s cheapest to connect. It could also decrease the cost of connecting new developments.

2.4.8 NETWORK PROJECTS AND INVESTMENTS

Significant investment in the maintenance and upgrade of the network is already underway. The following map shows the location and type of all GM projects with a value over £100,000.

NETWORK PROJECTS AND INVESTMENTS



2.4.9 STORAGE

If the UK is to change its energy mix from predictable, controllable sources such as fossil fuel power stations to less flexible and intermittent sources such as a substantial, continuous nuclear output and variable wind supplies, it may become necessary to make much greater use of local electricity storage to help balance supply and demand.

Types of storage include:

Hydroelectricity plant which pumps water uphill when surplus energy is available, and releases it to drive turbines during peaks in demand.

Chemical storage, such as batteries and similar technologies.

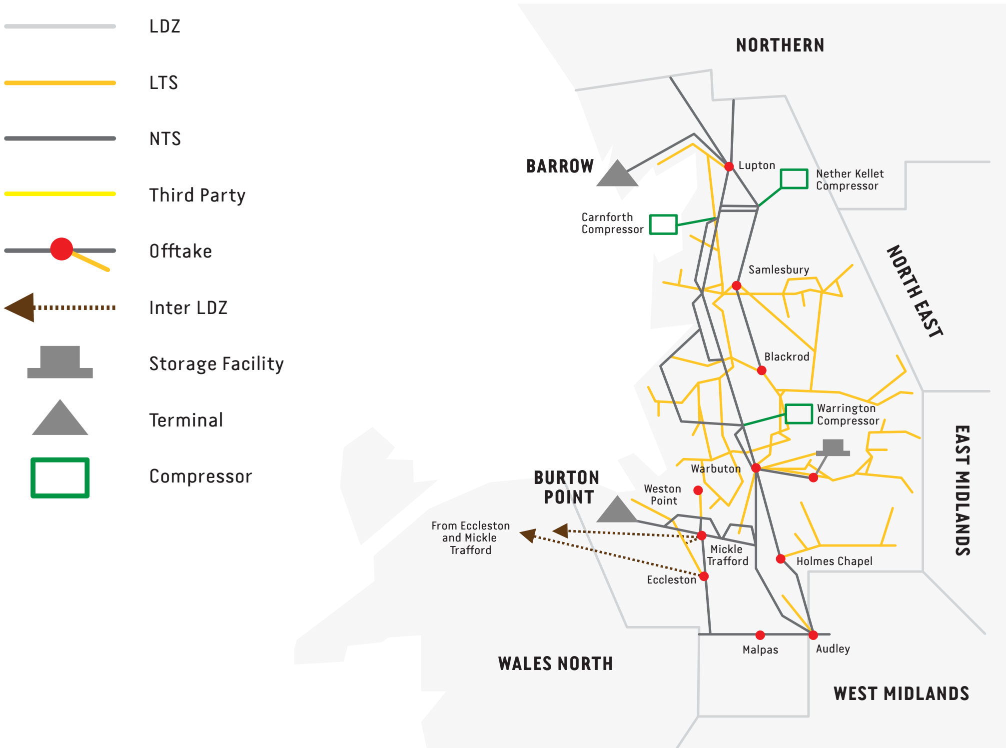
Hydrogen storage; by either chemically 'cracking' fossil fuels to produce hydrogen, or using off peak or intermittent electricity to produce hydrogen from water, to then be stored and distributed like other liquid fuels'.

Generator storage, using a locally stored fuel to generate electricity.

Storage solutions can be expensive, and so they are primarily used as an emergency resource. Many businesses and key institutions have a combination of battery and generator back up systems in case of disruption to their power supplies. As the UK's approach to smartgrids develops, it may be necessary to consider local storage solutions as a part of the energy mix. In the future, uptake of electric vehicles may lead to the potential for vehicle batteries to be used as local storage. However, it is anticipated that, between now and 2020, work in this area will be at the R&D, rather than deployment stage.

2.4.10 GAS INFRASTRUCTURE

The plan below shows the main gas infrastructure for the North West. Arrangements for Gas distribution in Greater Manchester are described in more detail in the Greater Manchester Decentralised Energy Study (see appendix). Gas distribution and the maintenance of gas pipelines is the responsibility of Transco.



The key challenges and opportunities facing the gas network include:

Challenges:

- The underlying security and stability of gas supplies
- Incorporating biogas derived fuels which may be of variable composition
- Accommodating the demand patterns of medium to large combined heat and power facilities
- Lead in times and costs of connecting new demand

Opportunities:

- Gas fired combined heat and power plants may be an important transition technology to enable the deployment of heat networks pending development of capacity in the biofuel market
- The use of gas fired thermal storage to help manage peaks and troughs in demand
- Incorporation of biogas into the network
- In the long term, a switch to using fuel cells to access energy from methane in a cleaner way.

2.5 HEAT

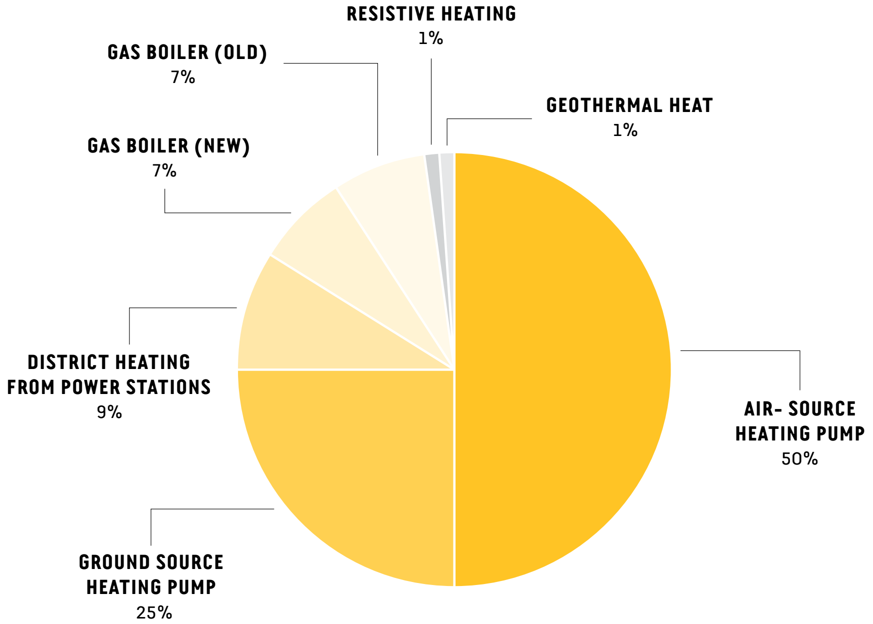
2.5.1 OVERVIEW

The forty years since 1971 have seen a dramatic shift in how the UK heats its homes and businesses. In 1971, fewer than 1 in 3 homes had any form of central heating, and only a small proportion were fuelled by domestic gas boilers. Now, over 90% of homes have central heating, and the vast majority (over 70%) are fuelled partly, or wholly by gas.

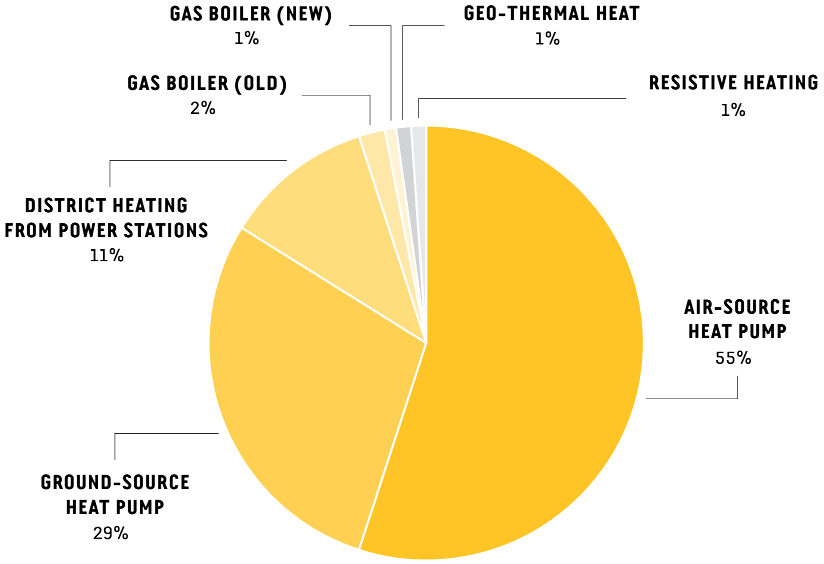
Heat accounts for more than 60% of household electricity bills, and is responsible for almost half of a home's CO2 emissions. The UK Renewable Energy Strategy includes a target to increase renewable heat as a proportion of total heat supplied from 1% to 12% between now and 2020, and to over 30% by 2030.

While the health and social benefits of central heating mean that it is here to stay, the use of gas in buildings to directly provide heat is expected to become increasingly unaffordable and could become unviable for many properties within the next two decades. Reliance on a single technology such as a domestic gas boiler to provide heat and hot water supplies is now expected to be phased out over the next 30 years, to be replaced by a diverse mix of technologies suited to the particular location and type of building being heated.

RESIDENTIAL HEAT IN 2050

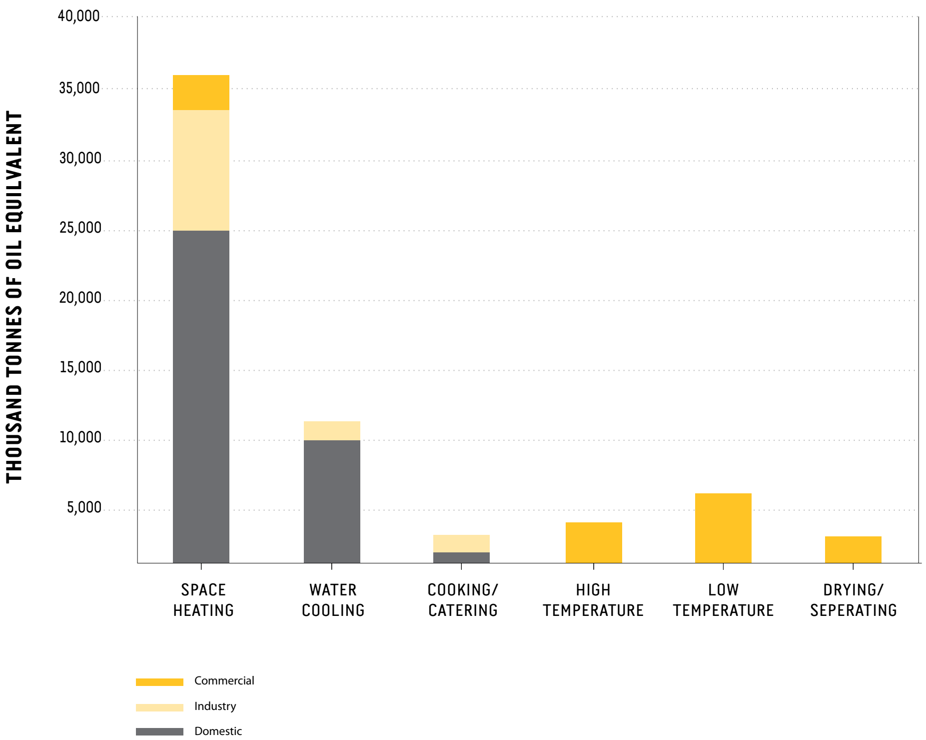


COMMERCIAL HEAT IN 2050



Homes and businesses across GM rely on an affordable supply of heat to warm buildings, cook food, heat water and power industrial processes. The table below provides an indication of the breakdown of UK heat use for 2008.

ENERGY CONSUMPTION FOR HEATING PURPOSES BY SECTOR AND BY END USE (2008)



GM RETROFIT: The most obvious solution to the problem of providing affordable heat is to reduce demand by improving the quality of building stock via new building standards and retrofit, and to improve the efficiency of heat generating appliances. A comprehensive programme of initiatives and measures to achieve this across Greater Manchester is underway, and this work will be reported separately.

2.5.2 DOMESTIC AND COMMERCIAL HEAT TECHNOLOGIES

Heat technologies include:

Heat Pumps	Ground source heat pumps: Ground source heat pumps are low-carbon heat-generating systems that usually circulate a mixture of water and antifreeze round a loop of pipe buried in the ground, which maintains a temperature of around 15°C even in winter. In new buildings, this loop can be buried vertically into the ground. When the liquid is pumped around the loop, it absorbs thermal heat from the ground. This heat can be transferred to radiators and under floor heating systems and it can heat water. The Energy Saving Trust puts the price range for ground source heat pumps between £9,000 and £17,000; The Centre for Alternative Technology says around £1,000 per installed kW as a rule of thumb.
Water Source Heat Pumps	Water source heat pumps operate on a similar basis to ground source heat pumps but the coils are placed in water, e.g. a pond or river.
Air Source Heat Pumps	An air source heat pump is positioned on or near the outer wall of a building and use a fan to extract ambient heat from the outside air. It works on the same principle as a domestic fridge, but in reverse. There are two types of ASHP: An air-to-water system uses heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system, so they are more suitable for under floor heating. An air-to-air system produces warm air, which is circulated by fans. [2] Air source heat pumps cost @: £5,000 – £9,000 (says CAT); £6,000 – £10,000 (EST) Heat pumps currently don't tend to heat water hot enough for washing and bathing and may require additional electricity to heat the water to the desired temperature which will mean higher electricity costs and not provide an immediate answer to private households facing fuel poverty. Because they do not take up much space, air source heat pumps are more likely to be used in flats and in urban areas, particularly in places where there is no mains gas supply, or to replace electric heating. [3]
Solar Thermal	Solar water heating systems use free heat from the sun to warm domestic hot water. A conventional boiler or immersion heater is then used to make the water hotter, or to provide hot water when solar energy is unavailable. **Costs** for a typical solar water heating system is around £4,800 (inc VAT at 5%).

[2] *www.decc.gov.uk/en/content/cms/meeting_energy/microgen/heat_pumps/heat_pumps.aspxHeat pump certification*
[3] *Adapted from : www.yougen.co.uk/renewable-energy/Heat+Pumps/ind a heat pump installer*

Biomass and Waste Derived Fuels

There are two main ways of using biomass for heating:

A standalone stove
Burning logs or pellets to heat a single space. Some can also be fitted with a back boiler to provide water heating as well.

A boiler
Burning pellets, logs or chips connected to a central heating and hot water system. A typical automatically fed pellet boiler for an average home costs around £11,500 including installation, fuel store and VAT at 5% [4]

At a commercial scale, biomass is increasingly adopted for schools as a least cost solution to delivering compliance with building regulations. However, when fuel and maintenance costs are accounted for, this can be expensive for schools to operate. A study undertaken by Red Rose Forest in 2008 suggested that the proposed uptake of biomass plant in Greater Manchester outstripped the capacity of the market to supply from affordable, sustainable sources. This view has been reinforced by recent government policy, which indicates a prioritisation of biomass schemes where they are located in close proximity to a regular fuel supply, or used in small scale heat applications unsuited to other renewable technologies.

CHP

CHP stands for combined heat and power. This refers to a heating technology which generates heat and electricity simultaneously, from the same energy source. Conventional boilers tend to operate at around 40% efficiency. By using the same fuel source to generate electricity, then capturing and using heat generated in the process, the useful energy yield can be increased from 40 to 70%. Small systems for use in individual homes or buildings are often called ‘micro CHP. Most CHP systems today use mains gas or LPG as a heating fuel, although they can also be powered by oil or bio fuels. Since they only generate electricity when there is a heat demand, Micro-CHP systems are most cost effective in houses with large heat demands that cannot be reduced by other means such as upgrading insulation, draught proofing and other low carbon heat technologies such as wood stoves. Typical installed costs are from £5,500. [5]

[4 and 5] *Energy Savings Trust*

Geothermal	Deep geothermal heat generation and distribution systems are commonplace in Europe where heat sourced from deep underground is extracted to the surface and the heat distributed via heat networks (see below) to customers located on the network. A 1986 study conducted by the British Geological Survey identified Manchester as a potential location for the development of deep geothermal systems due to particular geological characteristics, associated with its location over the Cheshire Basin. Greater Manchester's commercial potential for geothermal energy systems lies within the large heat demand of its urban areas. Unlike other technologies, deep geothermal energy is not intermittent and can deliver heat 24/7, but needs a relatively high base demand in order to make it commercially viable. There is potential for a number of geothermal systems to be developed in GM. Potential developers are already developing detailed project proposals at more than five locations in GM. Key challenges include a substantial initial development risk associated with the cost and failure rate of initial drilling, and the need to secure long term supply partnerships in order to secure a reliable return on high initial investment.
Excess Heat capture	A number of industrial and utility activities generate excess heat. These include waste water treatment processes, waste incineration, brewery and conventional electricity generation activities. Either on a site specific basis, or via the use of heat networks (see below) there is the potential to harness heat locally, rather than losing it to the environment via cooling towers or waterway heat release. A number of heat source opportunities have already been mapped in GM, and these are shown below.

2.5.3 HEAT NETWORKS

District heating is a system that distributes heat generated by a centralised plant for mass residential and commercial heating requirements such as space and water heating. [6] The networks (distribution — pipes and equipment) can be procured separately from the energy source. The energy required to heat the water or steam can be derived from a number of sources.

By creating economies of scale, and using local opportunities for low cost heat, such systems have the potential to deliver cost effective heating, replace fuel and cut CO2 emissions.

Sources could include:

Gas CHP or Biomass Boiler

Energy from waste (there are different technologies for extracting energy from waste: gasification, advanced thermal technologies, pyrolysis, anaerobic digestion and direct combustion (incineration). [7]

Surface and Geothermal resources

Following the production of the De-centralised energy study in January 2010 a number of schemes were investigated further largely led by Local Authorities in conjunction with a range of consultants, often part-funded by the Carbon Trust.

Further assessment of district heating initiatives in Greater Manchester by Ernst & Young identified four schemes that are similarly advanced and contain common features which suggest they may achieve economies of scale via a joint approach to planning and delivery.

These are:

Manchester Town Hall cluster
Stockport (Town Centre)
Bury (Pilsworth)
Bolton (Raikes Lane)

[6] *Ingrid Holmes, Climate Change Capital and Alasdair Young, Buro Happold 3 December 2008*
[7] *www.envirolinknorthwest.co.uk/Envirolink/Library0.nsf/0/9CA2AC0B2CED2DB7802578700034B1A6/$file/110412.Energy%20from%20Waste.pdf*

Manchester Town Hall Cluster	Manchester City Council has committed to the long-term development of an integrated heat network for the City Centre, extending to the Oxford Road corridor and to East Manchester, to be developed over 20 years. The area around the town hall has been identified as a potential area for the installation of one of the first heat network clusters. Capital requirements are estimated at between £26m – and £48m. The project would require the construction of a CHP plant that could be either gas or biomass fuelled, with additional gas fired boilers to meet peak demand. The energy centre could be located between 0.5km and 2.5km away from the cluster. The scope of the project is undergoing further definition and a business case being prepared.
Stockport — Town Centre	Stockport Council is considering a heat network as one of a number of options to deliver long-term low carbon energy to the town centre and have commissioned a detailed feasibility study. Potential heat off-takers have been identified. The most likely delivery vehicle will be private-sector led.
Bolton – Raikes Lane	Bolton Council is considering a number of Heat network opportunities including the GMWDA (Viridor operated) Raikes Lane (EfW) plant under which heat could potentially be piped to Bolton town centre.
Bury – Pilsworth	Bury Council and other stakeholders have considered the development of a heat network supplied by recovering heat from an existing electrical generation facility on the Pilsworth landfill site operated by Viridor.
Oldham — St Mary's Energy Centre	One of the most advanced scheme in the local government portfolio, and is based on an upgrade to an existing district heating scheme. This proposal is currently at the detailed delivery planning stage, and funds have been secured to progress its implementation.

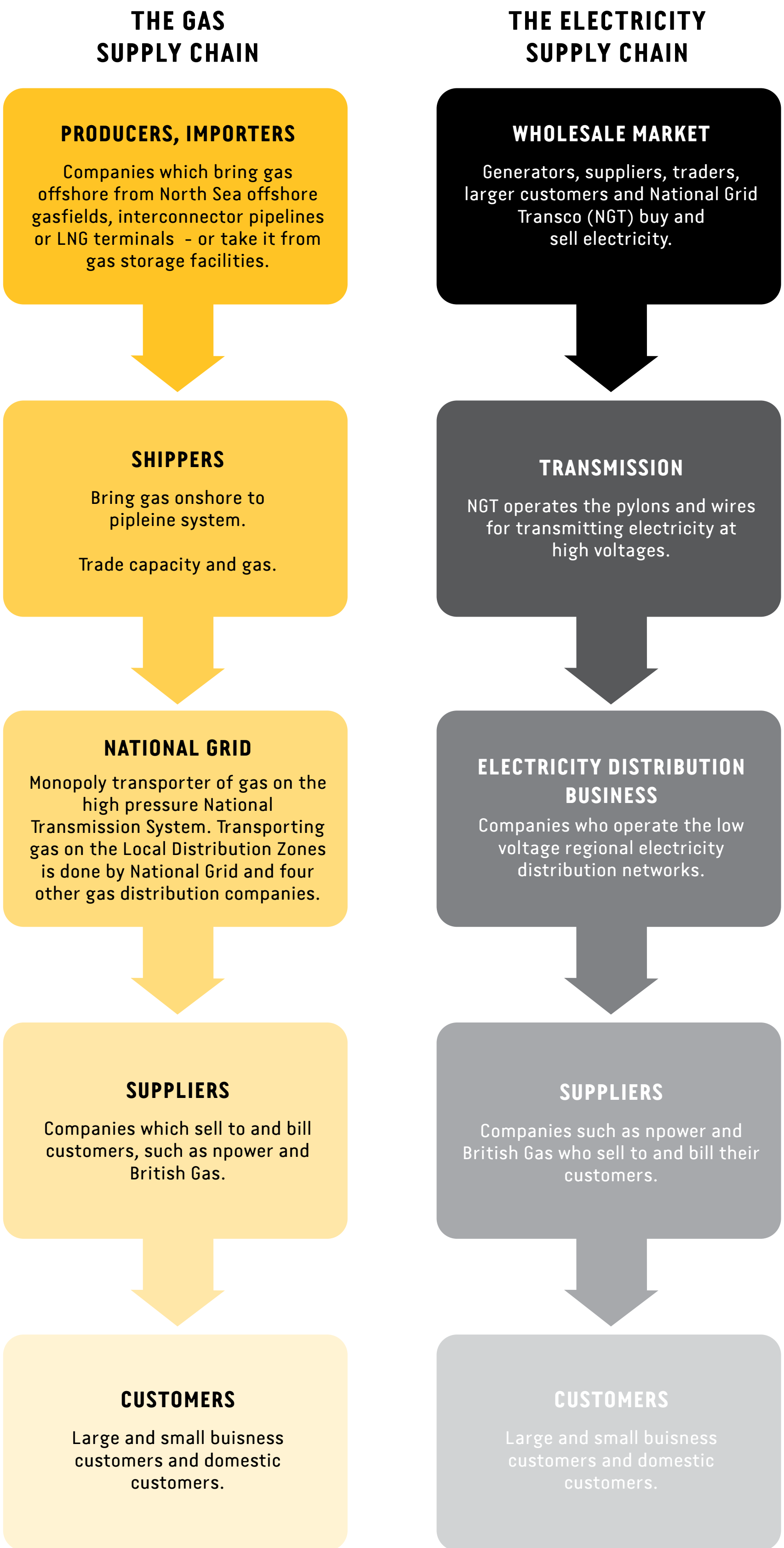
Rochdale and Salford have conducted early stage data gathering and Tameside, Trafford and Wigan are considering options. New opportunities continue to be presented by a range of public and private sector organisations, including a biomass scheme at Barton, Trafford and range of proposals for the new Noma Cooperative Headquarters which, subject to the appropriate planning processes, could make a significant contribution to GM's energy future.

CONNECTED: REPORT 3
THE ENERGY MARKET

3.1 OVERVIEW

The energy market brings energy from the producer to the consumer through a number of companies.

The following diagram illustrates the supply chains for gas and electricity:



Energy Generation Companies	Energy generation companies own and / or operate plant to produce electricity. They can range from major multinationals to small operators.
Fuel Sourcing and Supply Companies	These companies often act as intermediaries between smaller generators and energy supply companies.
Energy Supply Companies	Energy Supply companies buy power from the wholesale market, and sell it on to consumers via power purchase contracts. 99% of consumers purchase their electricity from six big companies, with over 100 companies sharing the remaining 1% of the market. This is a core area of concern for the Government, who intend to introduce a range of market reform measures to increase competition, improve the transparency of consumption and billing information, and achieve lower prices for consumers. Energy supply companies also recover a range of charges and levies on behalf of government and others, including the network 'transmission' charge. Many of the levies recovered are retained by energy supply companies on the basis that they operate energy efficiency and other schemes with consumers. The assignment of leadership to energy companies to deploy funds targeting energy demand reduction is under review, to ensure that future schemes optimise impact and value for money and are not undermined by perverse incentives.
Energy Distribution Companies	Energy transportation businesses are natural monopolies – there is no realistic means of introducing competition. In this sector, Ofgem is required to protect customers' interests by regulating the companies through five-year price control periods which include curbs on expenditure as well incentives to improve efficiency and deliver technical innovations. Greater Manchester's distribution company is Electricity North West, however there are a small number of local and 'private wire' companies for specific developments; one example being at Mediacity, Salford.
Customer	Customers have a choice of supply company, based on a complex range of price and other signals. Customers do not have a choice of generation source or distribution company. Electricity and gas supplies are procured from supply companies. The costs of maintaining energy distribution systems are often listed separately on bills, however costs are always recovered via the energy supply company rather than directly by distribution companies. Where large customers such as property developers need new connections or wish to connect generation technologies to the grid, depending on the size and scale, this may be procured directly from the energy distribution company.

3.2 GREATER MANCHESTER'S ROLE

Greater Manchester has few direct powers, duties or accountabilities in relation to energy infrastructure. Unlike water, and other strategic services, energy retail and distribution companies are not accountable to local authorities for their strategies and plans, other than as a general stakeholder via consultation activities. New energy developments do generally require local authority planning consent; however major developments are often overseen by national government.

However, energy is a critical infrastructure for Greater Manchester's economy and society. It plays a fundamental role in the profitability (or viability) of businesses and in the health, wellbeing, disposable income and quality of life of communities.

Inadequate infrastructure and unaffordable energy could act as a key barrier to wellbeing and growth, and deter people and businesses from Greater Manchester. The carbon intensity and amount of energy used is also the primary determinant of Greater Manchester's climate change performance. Greater Manchester's energy sector is worth over a billion, and employs tens of thousands of people. UK and EU Government Investment priorities mean that the coming decade will see a huge investment in energy - harnessing a share of this could significantly benefit Greater Manchester's economy.

Influencing the energy system, and ensuring it is conducive to wellbeing and growth is of significant importance to Greater Manchester. Although there are few regulatory levers which can be exerted, over the mid term, Greater Manchester could have a significant influence over its energy system in the following ways.

Procurement	Using existing local government and other collaborative procurement of energy as a lever to secure cheaper tariffs, increased local business presence and investment in new, secure local generation.
Trading	Considering the negotiation and establishment of value for money energy tariffs which can be offered to residents and businesses via collaborative purchasing, potentially including directly negotiating with generators and obtaining a supply license to become an energy retailer
Generation	Identifying and deploying energy assets within Greater Manchester that could secure supplies and act as long term income sources to support public services, carbon reduction, antipoverty measures and other investments
Planning	Developing and enforcing local authority plans which provide a clear vision of future energy requirements, are sufficiently explicit and robust to rapidly secure new low carbon energy generation and enable the deployment of adequate energy infrastructure. These systems should prevent and deter the deployment of generation which would exceed carbon targets, or the development of buildings and infrastructure which would lock in future users to energy intensive behaviours.
Estates and Assets	Ensuring that its own estates and assets are efficient, and integrating renewable energy technologies into building stock, will enable the public sector to act as a template, anchor and catalyst for a secure, low carbon energy future, create economies of scale, and provide business opportunities for the developing energy sector.

Skills	Ensuring that skills development programmes fully address the power engineering and wider energy skill sets necessary for a secure, low carbon energy future
Growth	Identifying and supporting our existing energy businesses, attracting new energy companies and projects to Greater Manchester, and providing access to finance and investment funding to enable rapid growth.
Knowledge	Promoting and growing the existing energy research base of Greater Manchester's Universities, and using their expertise to shape Greater Manchester's energy future

Greater Manchester and other cities are giving serious consideration to their future role and place in the energy system; whether to passively rely on national drivers and market forces to deliver adequate infrastructure and supplies at an affordable rate, or whether to seek to lead, drive and in some cases establish the deployment of infrastructure and trading systems within the national framework in a way which benefits their economy and communities.

3.3 MARKET REGULATION

Energy Market regulation is affected by UK and EU factors. Interactions between the companies above, their supply chains and customers are complex, and a number of factors influence the success of the market. The UK Government is concerned about a number of potential market failure issues, and is in the process of delivering a new regulatory framework which addresses problems of pricing, and improves the commitment and accountability of key regulated industries and businesses to the delivery of ensuring sufficient generation, carbon reduction, fuel poverty and other energy supply and security challenges, and has not ruled out the potential of a significant market reform.

3.4 IMPACTS OF RISING ENERGY COSTS

At the moment the UK energy supplies are heavily dependent on fossil fuels and imports from elsewhere – this leaves consumers vulnerable to volatile fuel prices as has been evidenced recently with oil prices and gas and electricity a couple of years ago.

In the short term renewable energy will cost more than that derived from fossil fuels, this is because of the cost of the new technologies. The government will initially subsidise these new technologies through a system of incentives to the private sector, but these costs will be passed back to customers through the energy companies.

In the medium to long term as gas and oil supplies start to become harder to secure, it is likely that their price relative to electricity generated by renewable sources will increase. At peaks in the market, some types of renewable energy generation such as wind have already become cheaper than fossil fuel derived supplies.

3.4.1 FUEL POVERTY

Fuel prices affect everybody in all sectors but increases are most critical for people with very low fixed incomes. When fuel costs account for more than 10% of a household's income, the household is described as being in fuel poverty. Greater Manchester has somewhere between 1 in 4 and one in five households living in fuel poverty, which is higher than the national average, and increases in the cost of energy would push many more into fuel poverty.

Government legislation addresses this to a degree, making suppliers respond to the needs of the most vulnerable but there is the potential to address this problem locally with improve energy efficiency measures being targeted to low income areas and using photo voltaics where suitable to capture energy which might benefit low income households.

Greater Manchester social housing providers have taken a lead and are advancing plans to install photo voltaics on the roofs of up to 90,000 homes taking advantage of the government incentives as an early pilot for the Green Deal. Affordable warmth strategies are in place across Greater Manchester to deal with fuel poverty. However, recent increases in fuel costs have overturned these gains, and without concerted intervention, particularly in the private rented sector, there is a risk that the numbers of households in fuel poverty may increase. As the majority of interventions needed to address fuel poverty take place at the Building stage, Greater Manchester's approach to fuel poverty will be reported separately as part of the Retrofit Plan and Affordable Warmth Strategies. However, it is essential to consider the impact on fuel poor households when strategic decisions regarding new large scale energy infrastructure are made, and when engaging with government on energy pricing and billing policies.

Key issues to address include:

Removing a perverse incentive to access cheaper tariffs by using more energy, and considering the potential of a 'basic needs' tariff, to encourage energy efficiency and ensure that high users of electricity pay a greater proportion of system costs.

Improving access to affordable tariffs for people in temporary accommodation including the removal of cost penalties for customers using pre-payment meters compared to direct debit or other users.

Prioritising fuel poor households for smart-metering and other technologies which may enable access to cheaper tariffs

Ensuring that communities willing to host new energy infrastructure see a direct community benefit from its co-location.

3.4.2 COMPANY PROFITABILITY

From a commercial perspective, although energy bills often represent a relatively small amount of company turnover, they often comprise a similar sum to company profits. This means that any savings made on energy bills can directly translate to significant profit gains. Conversely, the significant rises in energy costs experienced over the last decade have, for many companies, represented the tipping point between making an operating profit, or a loss. Rising energy costs were identified by financial analysts as a key contributing factor to over half of the manufacturing businesses who entered administration during 2009, and prices continue to rise.

However, the complex chains of building ownership, occupation and facilities management in place for much of the private sector mean that the companies suffering from rising energy costs rarely have control of the hard measures that would be needed to reduce bills. This complex landscape of drivers and barriers has been explored as part of the development of the carbon reduction commitment, and it is clear that much more active engagement will be needed between property investors, operators and occupiers to invest in low carbon infrastructure in commercial buildings in order for GM's businesses to remain profitable.

Key issues to address include:

Creating a better balance of incentives between landlords and occupants to ensure that the latest efficiency standards are applied to buildings.

Better enforcement of energy (and other) standards in social and private rented properties.

Ensuring that planning permissions and building consents take greater account of the operating costs for occupants and users in determining the energy standards and systems of new developments, including performance requirements for integrated energy using appliances pre-installed in new properties.

3.4.3 PUBLIC SECTOR BUILDINGS

Until recently, the funds provided to the public sector to manage their estates included an allowance for energy cost increases and this, to a certain extent, meant that there was only a moral and policy, rather than direct financial incentive for the public sector to address the performance of its stock. The current financial situation means that this is no longer the case. There is also a large and increasing overlap between commercial and public sector building stock, due to an increasing trend via PFI and other initiatives for the public sector to lease rather than own its stock. Local authority activity and building occupation can account for over 5% of total energy use, and so, with few major industrial sites across Greater Manchester, the local authority is, in some Districts, likely to be the single largest user of energy.

In order for ambitious carbon reduction targets to me met, and for the market to be stimulated and grow to the scale needed to meet demand, the public sector including local government, the NHS, police and fire services have a key role to play in transforming their building stock. The NHS is already making significant progress in this regard, and GM Fire and Rescue has been identified as a sector exemplar for its approach to service sustainability.

3.5 ENERGY PROCUREMENT

3.5.1 OVERVIEW

The most significant interaction that GM's local authorities, businesses and residents make with the energy market is via procurement. Due to the national approach to infrastructure, even if building integrated technologies are present, there is still a need to select core energy suppliers and enter into contracts with them. Similarly, many of the goods and services we purchase, ranging from our homes and cars, through to everyday small appliances have a cumulative impact on the amount of energy used.

GM has the potential to substantially shape both its, and the UK's energy future by:

Using collective procurement and detailed specification of energy contracts to secure local, low carbon, cost effective generation;

Stimulating demand for energy efficient technologies by actively seeking and investing in opportunities to reduce energy demand, and using local companies to deliver solutions

Ensuring that procurement decisions deliver long term value for money by incorporating long term energy and carbon costs into decisions about property, goods and services

3.5.2 ENERGY PROCUREMENT

Significant opportunities exist across Greater Manchester to use collective purchasing power to:

Drive down costs to end users

Incentivise suppliers to procure supplies from low carbon sources

Encourage suppliers to position energy supply chains within Greater Manchester.

Some organisations in Greater Manchester have already used these tactics to deliver significant cost savings while significantly improving the carbon footprint of their organisations.

3.5.3 COST BENEFIT ANALYSIS

The application of cost benefit analysis to include life-span operating costs in procurement decision-making is now widely deployed. However, it is common to use current, rather than forecast energy prices in the analysis which, due to their upward trend, lead to energy costs being underestimated, resulting in decisions which do not present value of money.

Even when government energy price forecasts are used, these are often overoptimistic about the effect of competition on price rises. An analysis of price forecasts produced in 2000 and 2005 suggests that energy prices have risen at least 50% faster than was previously forecast.

Financial management arrangements often result in a partition being drawn between responsibility for energy budgets, and budgets for energy using goods and services. Budget holders often do not directly benefit from savings resulting from the purchase of more energy efficient appliances.

A particular problem exists in the design and build of new property. As developers tend to construct, and then sell their property to a third party, there is little incentive other than regulatory requirements or brand to actively consider the energy costs of a building in operation to inform its design.

A good example of the effect of this is the deployment of biomass plant in new buildings. A biomass boiler can be the cheapest way of meeting building energy regulations at the design and build stage, where the inclusion of maintenance, fuel and operating costs would otherwise rule out its use. This then leads to occupants resorting to gas fired 'back up' systems for heating.

Similarly, where property is occupied by tenants, there is often a mismatch between the ownership and operation of energy using equipment, and the energy costs incentive to invest in technologies which would reduce demand.

A range of cost benefit models and tools which incorporate forecast energy costs and help to identify suitable property service charges to fund the deployment of energy efficient building technologies is now available, and these will be actively promoted to businesses and property owners across Greater Manchester.

3.5.4 ENERGY SECURITY

Threats to energy security include the political instability of several energy producing countries, the manipulation of energy supplies, the competition over energy sources, attacks on supply infrastructure, as well as accidents, natural disasters, terrorism, and an increasing reliance on overseas fuel supplies. Limited supplies, uneven distribution, and rising costs of fossil fuels, such as oil and gas, have increased concerns over energy security.

Threats to the supply infrastructure are dealt with by the UK Government as part of their national critical infrastructure programme. This is locally supported by Greater Manchester's Resilience Forum, who have a range of plans in place to identify and manage risks to GM's energy infrastructure.

Issues regarding securing long term supply are dealt with by DECC. The global availability of fossil fuel is forecast to peak during the early part of this century, with analysts views on. Known as 'peak oil', the issue of how best to manage a smooth transition from fossil fuels to other energy sources is a core part of DECC's brief.

The deployment of local, renewable energy supplies will increase the UK's energy security, while also supporting its economy.

There are three main macroeconomic considerations for energy security that have implications for Greater Manchester's ability to maintain business as usual, and to be competitive in a world market.

Peak Oil	The global availability of fossil fuel is forecast to peak during the early part of this century, possible as soon as 2014. Known as 'peak oil', the issue of how best to manage a smooth transition from fossil fuels to other energy sources is a core part of DECC's brief. 'Peak oil' is a strategically useful concept as, by identifying the point at which global (or UK) output is likely to peak, estimates can be made about the consequences of supply on the price and availability of energy, goods and services.
Gas balance	In 2004 the UK became a net gas importer and the UK Government estimates that more than 80% of gas will be imported by 2020. This has significant implications for our trade deficit in future years. The UK is reliant on a substantial gas interconnector between the Uk and Zebrugge, Belgium. There is an 'end of pipe' risk for the UK that Europe-wide persistent cold weather or other market supply and demand incidents could lead to UK supply problems, and the governance arrangements for resolving such matters are not wholly transparent.
Electricity interconnectors	The UK is increasingly reliant during peak periods, or during low generation periods, on electricity distributed via European interconnectors and these form a key part of the UK's future energy strategy. However, these are overseen mainly by a committee of network operators, and the extent to which the UK has influence over the governance arrangements for setting supply priorities during periods of regional or local supply constraint is unclear. The concept of a European Supergrid, currently being debated in the UK parliament may address some of these issues.

In all these cases, a significant increase in the amount of local power generation and storage will mitigate the impact of these macroeconomic factors on Greater Manchester.

CONNECTED: REPORT 4
LOW CARBON GOODS AND SERVICES SECTOR

4.1 **OVERVIEW**

A 2010 report by Innovas, Low Carbon and Environmental Goods and Services Sector Analysis for Greater Manchester, looked at the economic potential of the Low Carbon Environmental Goods and Services (LCEGS) sector. It identified an overall UK market size of £112,003 million for 2008/09. In terms of employment, the sector sees numbers of about 897,000 with about 57,000 specialist and supply chain companies. During an economic recession, this sector had managed to grow by 4.3% from 2007/08 and was forecast to grow by 3.4% in 2009/10, rising to 4.3% by 2014/15. GM has strong foundations on which to grow.

4.1.1 GREATER MANCHESTER'S LCGES SECTOR

The Northwest had a market value of £10,777 million in 2008/09 with about 4,985 companies employing about 86,500 people. Greater Manchester represents around 40% of this and can take advantage of the forecasted growth between 4.6% to 5.6% over the three years from 2009.

Further work undertaken by Innovas suggests that Greater Manchester has particular market strengths in the Built Environment and the universities are partnering with international companies on European and UK research programmes worth over £100 million.

Set against this, Greater Manchester currently uses around 60TWh of energy each year, spending over £5 billion on it, only a small proportion of which is spent within a Greater Manchester supply chain.

With only limited energy generation opportunities, Greater Manchester needs to focus on reducing and better managing its demand for energy, and increasing the exposure of Greater Manchester's companies to market opportunities associated with demand management and eduction.

The following table shows the market size, the number of companies and the number of employees within Greater Manchester for each area of business.

2008/09	GM £m	GM Co	GM Emp
Air Pollution	51	56	435
Environmental Consultancy	36	26	297
Environmental Monitoring	5	0	53
Marine Pollution Control	5	0	38
Noise & Vibration Control	7	1	63
Contaminated Land	59	34	491
Waste Management	109	51	959
Water and Waste Water	226	100	1,883
Recovery and Recycling	288	147	2,187
Hydro	14	6	133
Wave & Tidal	3	0	21
Biomass	155	62	1,463
Wind	521	228	4132
Geothermal	279	123	2,300
Renewable Consulting	18	9	175
Photovoltaic	149	76	1,233
Alternative Fuel Vehicle	608	259	4,896
Alternative Fuels	933	373	7,008
Additional Energy Sources	73	32	615
Carbon Capture & Storage	35	16	297
Carbon Finance	8	2	40
Energy Management	109	50	920
Building Technologies	562	242	4,471
TOTAL ALL SUB SECTORS	4,253	1893	34,120

Source: Innovas

Greater Manchester has comparative economic strengths (compared to the Northwest and UK) in the following sub sectors:

Contaminated land remediation (leading position UK)

Carbon capture and storage (leading position UK)

Additional energy sources (leading position UK)

Alternative fuels

Alternative fuel vehicles

Environmental consultancy

It has slightly above average performance in the following larger sub sectors:

Building technologies

Energy management

Wind energy

There are also clear areas of research and academic strength in the built environment, building technologies, aerospace and automotive engineering and various renewable energies and new energy sources.

4.1.2 TAKING THE LEAD

Greater Manchester could support and build a leading position in both the UK and internationally in:

The built environment combined with building technologies – there is the opportunity to develop a world class capability and industry in a sub sector which has fast growing UK and international markets.

Low carbon aerospace and aviation technologies and services – these are a relatively specialised area but one where Greater Manchester is already well placed in terms of research and development.

New energy sources and technologies – drawing on our strong research capabilities in these areas there is the opportunity to become a centre for developing and commercialising new energy technologies.

Energy networks, with university expertise and sectoral leadership combining with leading Greater Manchester companies such as Siemens, Electricity North West and others.

4.2 KEY ACTIONS

To capitalise on these strengths Greater Manchester intends to employ the following tactics:

- Boost sector market capacity in terms of conducive planning requirements;
- Identify opportunities involving the public sector estate;
- Use procurement to stimulate the market and the potential for economic growth;
- Engage with FE and HE institutions to boost the quality and availability of CPD and training;
- Actively promote low carbon technologies and services as a core strand of business support and inward investment activities;
- Establish effective business engagement and support activities.

A Low Carbon Economic Area work programme is in place to address the issues above, including comprehensive approach to business support.

Its workstreams aim to:

- Understand the Low Carbon and Environmental Goods and Services market in Greater Manchester;
- Support growth and investment in the LCEGS sector;
- Increase resource and carbon efficiency within all sectors in Greater Manchester.

4.3 ENERGY SKILLS

Underpinning GM's growth plans is a programme of engagement and activity to ensure that businesses have access to the energy skills and capabilities needed to support a transition to a low carbon economy.

A Green technology centre has been launched at Oldham college, providing key facilities to equip GM's work force with practical skills in low carbon technologies and services. (ins photo) low carbon economic area work programme aims to tackle the delivery of skills across the low carbon and energy sector.

Its priority workstreams are to:

Understand the different workforce requirements for sector organisations, aiming to complete research on existing and predicted skills needs by December 2011;

Understand the proportion of those jobs that can be undertaken by the existing market, including relevant companies and the supporting organisations.

Identify and develop appropriate training programmes and career development pathways for each of the jobs and occupations created through each work programme;

Ensure that high quality, impartial advice and information is available to employers and prospective learners – stimulating demand for training;

Ensure training is adequately resourced and financed;

Ensure there is appropriate capacity in place within the local training infrastructure, including the development of new capital facilities as appropriate.

4.4 OUTCOMES AND INTERVENTIONS

OUTCOME

To have created market opportunities for the £100 million of energy research being undertaken by Greater Manchester's universities, and work to increase the size, economic and jobs contributions of Greater Manchester's energy sector;

To have developed a co-ordinated approach to business support networks that help businesses to realise their full potential in contributing to and benefiting from a low carbon economy. Providing companies with access to knowledge, expertise and practical skills that help them innovate, adapt, reduce their exposure to climate change risks and increase their resource efficiency;

These networks will, actively stimulate and suppor companies to develop low carbon environmental goods and services, having created an effective local supply chain capacity necessary to make retrofitting;

and energy programmes an attractive investment proposition, thereby creating local jobs and supporting social, economic and environmental development in a carbon constrained world.

INTERVENTIONS

Enable the right market conditions to be developed to promote investment and action in Greater Manchester via establishing appropriate governance and partnership arrangements which promote strong working relationships with key energy organisations;

Influence the development of energy programmes to ensure that training and supply chain support are integrated into their development;

Influence existing and new energy generation and distribution companies to ensure they have effective strategies for resilience, adaptation and the upgrading of networks, and the connection of low carbon technologies.

Develop extended and aligned networks of green business support and development to meet the needs of all types of business organisations.

Align these networks to stimulate the market for low carbon environmental goods and services.

Support companies to better understand the carbon levels in their supply chains and take action to manage and mitigate this.

Actively promote green 'business-to-business' activity to accelerate demand.

Maximise the opportunity for business engagement in carbon measurement, reporting and promotion across GM.

Influence and support new low carbon / low resource social enterprise

Identify and support green collar enterprise as well as collaborative sustainable consumption and production opportunities across Greater Manchester.

CONNECTED: REPORT 5
SIXTH WAVE OF INNOVATION

5.1 **OVERVIEW**

From the Industrial Revolution, through to steam power, electricity and biotechnology, the energy sector's performance is one of the key drivers of growth, and is increasingly important for future growth. Strong economies throughout history have always been those at the forefront of innovation and, although these waves of innovation take a global view, Greater Manchester has been a major player in each of them.

From the first days of the industrial revolution Greater Manchester has been a global force for industrial – and energy – innovation. Our earliest entrepreneurs used coal and steam to create an international textiles market. The age of rail, of electricity and then of the atom all saw Greater Manchester playing its part.

Fast forward to the present day and the current wave is concerned with digital technologies, biotechnology, and even new media. Our researchers have discovered graphene, with its massive potential for cleaner technology solutions and are pioneering on green nanotech and the 'quantum dots' that could transform low energy lighting and photovoltaics. Greater Manchester is already looking to be part of the next wave of economic transformation – as explored by the Natural Edge project, the 'sixth wave of innovation'. By applying the common characteristics of each wave of innovation in the past, they have suggested that the next major wave will be associated with sustainability, with renewable energy technologies playing a major part. This means that areas with low exposure to imported fossil fuel derived energy supplies and significant market presence in the energy sector are more likely to experience secure, economic growth.

To be a real player in this, Greater Manchester needs to look carefully at how to increase its sustainability technologies and services. And a key part of this is ensuring that the availability, price, reliability and carbon performance of energy supplies are secure, as these are fundamental to economic success. Similarly, we also need to bear in mind that the technologies associated with each phase of modern development have generally taken a century or more to pass from concept and demonstration into mass uptake and the mainstream. We can't underestimate the effort it will take to scale up the deployment of technologies already in the pipeline.

5.1.1 MANCHESTER AND THE SIXTH WAVE

GREATER MANCHESTER'S CHALLENGE

From the first days of the Industrial Revolution, the towns and cities of Greater Manchester have played a critical part in five distinct waves of global innovation. Each of these waves featured disruptive new technologies that transformed the way we live and the way we do business. Our challenge now is to take our place at the crest of the sixth wave: an age where resource efficiency, sustainable technologies, zero waste and the race to curb carbon emissions will be the true driving forces of commerce and enterprise.

SIXTH WAVE VALUE

Disruptive, innovative solutions that make better use of natural resources and offer a cleaner or less wasteful alternative are often referred to as 'cleantech'. The current global market for cleantech products and services is about £177 billion, growing to over £800 billion in 2017. Of this amount more than one-third (£290 billion) is attributable to renewable energy sources, such as biofuels, solar, tidal, and wind power. Together these segments are expected to grow from a current value of £64 billion to approximately £290 billion in 2017. The cleantech market is the third largest venture-capital investment category, behind only biotech and software.

GREATER MANCHESTER CLEANTECH

Greater Manchester's cleantech sector in 2009 was judged to be worth £4.2 billion across 1,900 companies and employing 34,000 people. It also showed strong annual growth of 4.3%.

THE SIX WAVES	1ST WAVE	2ND WAVE	3RD WAVE	4TH WAVE	5TH WAVE	6TH WAVE
	Iron *Water power* *Mechanisation* *Textiles* *Commerce*	*Steam* *Railroad* *Steel* *Cotton*	*Electricity* *Chemicals* *Internal combustion engine*	*Petrochemicals* *Electronics* *Aviation* *Space*	*Digital networks* *Biotechnology* *Software* *Information technology*	*Sustainability* *Radical resource productivity* *Whole system design* *Biomimicry* *Green chemistry* *Renewables* *Green nanotech* *Future Internet*

MANCHESTER INNOVATIONS

- 1733 John Kay invents the 'flying shuttle' for weaving
- 2011 Manchester-led Spinnaker project aims to model the human brain
- 1783 Arkwright builds the first steam driven textile mill
- 2011 Manchester researchers develop solar nanotech at Photon Science Institute
- 1951 Kilburn and Williams develop the the Ferranti Mark 1 Computer
- 1803 John Dalton unveils his atomic theory
- 2008 Professor Brian Cox joins team searching for the 'God Particle' at CERN
- 1957 The Lovell telescope at Jodrell Bank identifies maiden flight of Sputnik, the space race is launched
- 1965 University of Manchester unveils an undergraduate course in Computer Science, the first of its kind
- 1830 First ever passenger steam railway, between Manchester and Liverpool
- 1984 Manchester's Ocean Software launches, to become one of the world's biggest games software companies
- 1903 Henry Royce builds first Rolls Royce automobile
- 2005 Europe's largest vertical solar array, on Manchester's CIS Tower, is switched on for the first time
- 1838 Cobden and others begin moves towards free trade
- 1990 Poptel launches the world's first digital co-operative in Manchester
- 1908 The first British plane is designed and flown by A V Roe
- 1998 TeleCity opens in Manchester and goes on to become one of Europe's leading network of data centres.
- 1844 The Rochdale Pioneers launch the world's first successful co-operative, today 1 billion people worldwide are co-operators
- 2012 Green digital charter for Manchester
- 1919 Ernest Rutherford discovers how to split the atom at Manchester University
- 1894 Opening of the Manchester Ship Canal
- 1997 Manchester Network Access Point, Britains second internet hub, was founded
- 2004 Graphene discovered at the University of Manchester

1785 1845 1900 1950 1990 2020

5.1.2 SIXTH WAVE TECHNOLOGIES

It's a bold claim to predict the future of our energy sectors, but the technologies spearheading this 'sixth wave' are truly at the cutting edge of innovation. Biomimicry, industrial ecology, renewable energies, green chemistry and radical resource productivity are just some of the systems that can both provide energy and promote sustainability. And we now possess both the technological innovations and know-how to tackle many environmental problems cost effectively and even profitably. In practice, these innovations can manifest in diverse areas such as green buildings, hybrid cars, wind turbines or recycling. Greater Manchester's electric vehicle revolution will launch in Autumn 2011 and the region's track record on renewable energy, including the solar panels on the CIS Tower and wind turbines on Scout Moor, are just a small selection of the commitment the area already has to a sustainable future.

> "IT'S ALL ABOUT RESOURCE EFFICIENCY AS OPPOSED TO RESOURCE CONSUMPTION."

5.1.3 INVESTING IN THE SIXTH WAVE

Innovation is increasingly acknowledged as central to achieving lasting economic growth. Investment in the research, development and adoption of these innovations can promote competitive advantage and guarantee Greater Manchester's standing as a low carbon city. The Stern review in 2006 set out the economic case for action on climate change and investment in the low carbon economy. The Greater Manchester 'mini-Stern' applied its findings to Greater Manchester's local economic context, and identified a £20bn opportunity cost to Greater Manchester of failure to respond to the agenda. Work undertaken by Ernst and Young in developing a low carbon Investment portfolio for Greater Manchester identified that the national targets for climate change and energy security necessitate an investment of in excess of £400 billion between now and 2020. While much of this is embedded in national and international programmes, Greater Manchester needs to minimise the costs to its businesses, organisations and individuals in complying with regulations, and create a secure platform by which Greater Manchester can access low cost investment for secure, low carbon energy supplies.

Key sector strengths across Greater Manchester:

Carbon Capture and Storage*

Additional Energy Sources*

Alternative Fuels

Alternative Fuel Vehicles

Environmental Consultancy

Building Technologies

Energy Management

Wind Energy

In 2008/9 the global market for low carbon goods and services was worth US$ 5 trillion and this is forecast to grow by 45% by 2014/15. The US has the biggest market share in this sector while the UK's position has slipped, from 6th in 2008/9 to 13th in 2010/11.

The overall market value of Low Carbon Economic Growth Sectors (LCEGS) in Greater Manchester is £4,2bn, across 1,900 companies and employing 34,000 people.

** Leading position in the UK*

> "URGENT ACTION IS NEEDED TO ENSURE WE DO NOT MISS THE OPPORTUNITY TO BE PART OF WHAT MANY ARE CALLING THE 'NEXT INDUSTRIAL REVOLUTION'."

5.1.4 GREATER MANCHESTER'S INNOVATORS

Greater Manchester hosts a substantial range of innovators across the energy systems agenda. This ranges from Ener G in Salford who have developed new technologies and business models for CHP deployment through to companies in Bolton leading the way on low energy street lights to the Co-operative Group's leading edge work on low carbon energy investment.

The Energy Innovation Centre holds annual awards, with a number of GM businesses securing recognition for their practical innovations across the Energy System. Examples of leading GM innovations include:

Greater Manchester's MHA Lighting Ltd, who has developed energy efficient LED lighting solutions for public and private sector organisations throughout the UK.

The University of Bolton's Institute for Materials Research & Innovation (IMRI), has developed a unique fibre which is capable of being woven into fabric to make large and small structures that can harvest the sun, rain, wind and tides and convert it into usable energy.

5.1.5 UNIVERSITIES INNOVATION

GM hosts unrivalled energy research capability, with a particular focus on industrial partnerships and technology innovation. The two main centres of excellence are the Universities of Manchester and Salford, who combine annual research valued at over £100 million.

5.2 **UNIVERSITY OF MANCHESTER: ENERGY INITIATIVES**

Nationally, UoM is one of the top four recipients of Research Council funding for energy research. More than £70m of active grants are currently held by c.150 academics. It also hosts key Tyndall Centre activity providing internationally renowned thought leadership on climate change and energy challenges.

Consideration is being given to the establishment of a cross university energy coordination body, to help ensure that the university's multidisciplinary capabilities on energy are better understood and more effectively promoted.

The following examples are illustrative of current activities and capability:

High Voltage Laboratory	The National Grid Power Systems Research Centre houses the largest and best equipped high voltage laboratory of any UK university. With a 2MV impulse generator, 800kV AC set and 600kV DC set it can test equipment used on the high voltage transmission system of England and Wales ensuring electrical energy can be transported efficiently and reliably.
Carbon accounting	The CCaLC carbon footprinting tool developed at UoM enables quick and easy estimations of the life cycle greenhouse gas emissions along the whole supply chain. It provides a powerful tool for reducing and managing carbon footprints of products, processes or supply chains. The methodological approach follows the internationally accepted life cycle methodology as defined by IS0 14044 and PAS2050 and is simple to use by non-experts.
Development of new solar technology	Groups are developing the important elements of third and future generation solar cells. Targets include dye-sensitised cells, hybrid inorganic-organic cells, all organic cells and artificial photosynthesis and research encompasses all aspects of chemical synthesis, formulation of stable dispersions, photo-physical measurements, device fabrication and testing. Related work is also being undertaken to improve the understanding of the impact of solar generation on-grid and off-grid.
Electrochemical Energy Storage	Research is carried out on batteries, super-capacitors and fuel cells by teams from a number of schools across the campus ensuring an integrated approach from component to application is followed. Research outputs are expected to improve portable power sources for use in vehicles.
Biofuel Production	The Centre of Excellence in Biocatalysis, Biotransformations and Biocatalytic Manufacture (CoEBio3) collaborates with a range of industrial and academic partners throughout the world in the discovery and evolution of novel enzymes and in the development of biochemical engineering solutions for the production of biofuels.
Hydrocarbon Exploration & Development:	Capability in this area incorporates all aspects of the sedimentary basin system, from source to sink and from micro- to macro-scales. Projects integrate structural, sedimentological and geomorphic studies and span the fundamental and petroleum geosciences and use state-of-the-art acquisition, modelling and interpretation tools.

Advanced Manufacturing	The Dalton Nuclear Institute is addressing the skills and research needs associated with nuclear energy and medicine for the benefit of society now and in the future. Its new Nuclear Advanced Manufacturing Research Centre laboratories will assist prototype manufacture, materials testing and safety applications.
Education	UoM's education activities produce over 10,000 graduates a year many of whom will work on the development, management and adoption of new energy technologies. The creation of a cross-campus University College could see energy being introduced to the curriculum as a topic for study by all undergraduates. Specific postgraduate training is offered in areas such as nuclear engineering through the EngD and Nuclear FiRST Doctoral Training Centres. UoM also delivers continuing professional development courses tailored to the needs of industry such as the BP Executive Education Programme.
Partnerships	Major industrial partners include BP, Électricité de France (EdF), IBM, National Grid, Rolls-Royce, Serco, Shell, Siemens and Westinghouse and the forthcoming launch of UMIC's Low Carbon Incubator Centre on Grafton Street will provide new opportunities for SMEs and start-up companies to work with UoM to develop low carbon and environmental goods and services.
Smartgrids	UoM's high voltage laboratory and wide range of network expertise lends itself to addressing the challenges of rolling out smartgrids. Supporting a wide range of partners, UoM's expertise has led to Manchester being selected as the host for the internationally significant Innovative Smart Grid Technologies conference in December 2011.
Lab Manchester	UoM has over 300 buildings on 120 hectares of estate. This diverse range of property includes cutting edge research facilities such as the AV Hill Building. Through existing infrastructure such as UoM's own extensive high voltage power network and the distributed steam supply for heating and local generation the estate acts a laboratory for testing new approaches to energy generation, distribution and use within the context of a major urban centre.

5.3 ENERGY SALFORD

Energy is one of six overarching themes which cut across Salford University's Teaching and Learning, Research and Innovation and Enterprise and Engagement activities. There are four workstreams, including Energy Generation, Energy Conversion and Demand Reduction, Socio-economic Issues and Aspects of a Low-Carbon Lifestyle and Resources. Recognised by Government as the UK's foremost university for sustainable built environment issues, the university also has a well established energy portfolio, supported by a dedicated EnergySalford web resource.

Current initiatives include:

Retrofit Salford	The first and only annual conference dedicated to sharing cutting edge knowledge and expertise on meeting retrofit challenges.
Research and Innovation	Materials, thermal testing and structure laboratories and wind tunnels underpin work with a wide range of commercial clients.
Commercial Enterprise	R&D programmes have resulted in a wide ranging portfolio of technology based license-ready patents for industry and commercial relationships for the mutual development of intellectual property are a key part of activities.
Energy House	Is Europe's 1st and only Energy House; a victorian era property that has been reconstructed in a fully environmentally controllable chamber, in which climatic conditions can be maintained, varied, repeated and patterns monitored. Salford Energy House provides a unique testing and development facility in which leading researchers can work collaboratively with industry to develop and test new technology and solutions to improve the energy efficiency of existing projects and processes.

CONNECTED: REPORT 6
REGULATORY FRAMEWORK

6.1 **EXISTING REGULATORY CONTEXT**

The government's develops and implements energy policy and market regulation primarily through the Department of Environment and Climate Change (DECC), however energy policy and regulation is also present within BIS in terms of market regulation, and DCLG associated with its planning policies, building regulations and development control.

DECC works to ensure that the right legislative framework is in place to meet the government's policy objectives:

Reducing greenhouse gas emissions in the UK,

Confirming global commitments to tackle climate change, and

Ensuring secure, affordable energy supplies.

This legislative framework sets the regulatory environment for energy supply and distribution and sets in place the incentives required to drive the market towards low carbon activity.

The Climate Change Act 2008 introduced legally binding targets for an 80% cut in green house gas emissions by 2050 and a 34% in emissions by 2020, both these targets are set against a 1990 baseline. The fourth Carbon Budget presented in May 2011 confirms the government's commitment to these ambitious targets.

The Energy Acts of 2008 and 2010 introduced and strengthened incentive payment systems to encourage the adoption of renewable energy. These payments are targeted at different sections of the market and are designed to reflect the fact that in the short to medium term renewable energy infrastructure is much more costly to build than conventional fossil fuel plant.

Recent announcements suggest that the policy and legislative framework outlined below will be reformed with a package including;

An announcement in Budget 2011 that the Government would put in place a Carbon Price Floor to reduce investor uncertainty, putting a fair price on carbon and providing a stronger incentive to invest in low-carbon generation now;

The introduction of new long-term contracts (Feed-in Tariff with Contracts for Difference) to provide stable financial incentives to invest in all forms of low-carbon electricity generation. A contract for difference approach has been chosen over a less cost-effective premium feed-in-tariff;

An Emissions Performance Standard (EPS) set at 450g CO2/kWh to reinforce the requirement that no new coal-fired power stations are built without CCS;

ACapacity Mechanism, including demand response as well as generation, which is needed to ensure future security of electricity supply.

6.2 **INCENTIVES FOR RENEWABLE ENERGY GENERATION**

RENEWABLE OBLIGATION CERTIFICATES (ROCS)

This system is directed at commercial scale renewable energy and is set to deliver 11% renewable electricity in 2010/11, rising to 15.4% in 2015/16. ROCs are given to renewable generators for each MW of electricity generated. The generator can then sell this certificate to suppliers who are obliged to source a percentage of their electricity from renewable sources. Suppliers who do not meet this target are penalised. Since its introduction in 2002 this system has succeeded in tripling the level of renewable energy in electricity from 1.8% of the total to 6.64%. The ROCs system is in statute to exist until 2037 giving long term certainty to generators.

FEED IN TARIFFS

Feed in Tariffs were introduced in April 2010 and are directed at small scale (less than 5MW) generation of electricity by people who are not part of the electricity market. The ‘clean energy cash back’ will be paid by energy companies to people who invest in micro generation, for electricity fed back into the grid and for that they use. Again to provide confidence to early investors the payments are guaranteed over long periods of time under a system where a proxe is fixed on commissioning of the plant. This process is known as ‘grandfathering’.

The first review of larger scale solar and anaerobic digestion FiTs was announced in June 2011, reducing the tariff for larger scale projects (greater than 50MW) protecting resources for smaller scale projects.

RENEWABLE HEAT INCENTIVE

This financial measure is being introduced in the 2011 Energy Bill. The first phase of long-term tariff support will be targeted in the non-domestic sectors, at the big heat users — the industrial, business and public sector — which contribute 38% of the UK’s carbon emissions. Payments will be made to the owners of the renewable heat installations.

The second phase of the RHI scheme will see households moved to the same form of long-term tariff support offered to the non-domestic sector in the first phase. This transition will be timed to align with the Green Deal which is intended to be introduced in October 2012.

6.3 **INCENTIVES FOR ENERGY EFFICIENCY**

THE CARBON REDUCTION COMMITMENT ENERGY EFFICIENCY SCHEME (CRC)

CRC is a mandatory carbon emissions reporting and pricing scheme to cover all organisations using more than 6,000MWh per year of electricity (equivalent to an annual electricity bill of about £500,000). The CRC came into force in April 2010 and aims to significantly reduce UK carbon emissions not covered by other pieces of legislation. The primary focus is to reduce emissions in non-energy intensive sectors in the UK. Participants need to measure and report on CO2 emissions with a first report due in 2011. In 2012 allowances per tonne of CO2 have to be paid to government, the cost per tonne was previously set to be £12 although since the Spending Review this figure has been under review. The group of users that the scheme targets generate 10% of CO2 emissions, around 55Mt CO2 per year, the aim is to reduce this by 4Mt by 2020.

Almost all local authorities and hundreds of businesses across GM are liable under CRC. Work to create consistent tools for calculating, reporting and meeting emission reduction targets is underway.

Until recently the following energy efficiency obligations applied to energy companies with over 50,000 customers but this was changed to apply only to those with over 250,000, in an attempt to encourage more small suppliers into the market.

CARBON EMISSIONS REDUCTION TARGET (CERT)

CERT requires gas and electricity suppliers to achieve targets for a reduction in CO2 emissions by the domestic sector. Ofgem sets targets for all suppliers with more than 250,000 customers to make savings for customers. They do this by promoting the uptake of low energy solutions such as insulation to lofts and cavities either free or at low cost. The focus should be on those most at risk of fuel poverty such as those on benefits who are elderly or who have small children.

COMMUNITY ENERGY SAVINGS PROGRAMME (CESP)

CESP is similar to CERT but is more of a whole house approach and is targeted at areas of multiple deprivation. This has been used to deliver some of the Greater manchester retrofit. The Government is also currently consulting on **Electricity Market Reform** – investigating the likely effectiveness of a range of incentives designed to stimulate more low carbon electricity generation.

MARKET REGULATION

The Utilities Act 2000 established Ofgem as an independent energy regulator for England Scotland and Wales. Ofgem's main objective is to protect consumers' interests through effective competition or by other means. To take part in the energy market an energy company must have a licence for generating, supplying, distributing or transmitting.

Generation and supply are considered to be fully competitive markets so there is no price regulation. Distribution and transmission are monopoly networks and are subject to price regulation. Prices are reviewed every five years and they include consideration of investment requirements.

6.4 FUNDING INFRASTRUCTURE

Network operators and transmission companies meet the costs of infrastructure themselves although as price controls are agreed on the basis of projected requirements, costs are effectively passed on to customers. As part of the new price control arrangements that run from April 2010 to March 2015 Ofgem has set up a Low Carbon Network Fund to support large-scale trials of advanced technology including smart grids, and new commercial arrangements with customers. These advances will help the networks to accommodate growth in local generation, electric vehicle use and other developments anticipated in a lowcarbon economy

6.5 EUROPEAN ENERGY POLICY

The Treaty of Lisbon established energy policy as a central strand of European activity. Its Energy policy is supported by regulation, legislation, market-based tools (mainly taxes, subsidies and the CO2 emissions trading scheme), by developing energy technologies (especially technologies for energy efficiency and renewable or low-carbon energy) and by Community financial instruments. The European Commission distributed over £2 billion in funding during 2011 in pursuit of its energy priorities, and, setting aside one off allocations associated with the financial crisis, energy spending is a rapidly increasing proportion of the overall European budget.

6.5.1 KEY IMPLEMENTING MEASURES:

A Policy For Energy	A range of policies and strategies, including a strategy for competitive, sustainable and secure energy, and policy drivers to increase renewable energy generation and improve energy efficiency.
Market-Based Instruments	These include the Greenhouse gas emission allowance trading scheme (EU ETS), a framework for the taxation of energy products and electricity, and various product labelling and performance codes of conduct.
Research And Innovation	Programmes cut across improving the efficiency and impact of fossil fuel generation including carbon capture and storage, plans for the development of low carbon and other energy technologies.
Financial Instruments	The Competitiveness and Innovation Framework Programme (CIP) (2007–2013) and Seventh Framework Programme (2007 to 2013) support a wide range of financial instruments and funding streams (Intelligent Energy Europe, CONCERTO, INETRREG, ERDF, URBACT, ELENA) to progress European Energy policy.

6.5.2 ENERGY EFFICIENCY DIRECTIVE

Members are subject to a binding target to generate 20% of energy from renewable sources and a non binding target of improving energy efficiency by 20% by 2020. The UK is in a minority of countries who do not currently seem likely to meet their renewable energy target, however all countries are finding the energy efficiency target extremely challenging. The European Commission is currently in the final stages of development of a Directive on Energy Efficiency.

The Directive includes a proposed 3% per annum energy performance renovation target for public buildings, and an increased responsibility on national governments to ensure detailed and spatially defined infrastructure plans are in place to meet future energy targets.

6.5.3 PLANNING, BUILDING AND PROPERTY MARKET REGULATION

The new National Planning Framework makes it difficult for local authorities to ensure that properties are built and managed in a way which will achieve carbon reduction, economic productivity, antipoverty and energy security goals.

A desire to make the planning process more streamlined may further inhibit the ability of authorities to ensure that buildings and homes are designed, built and managed in a way that enables occupants to behave in ways aligned with low carbon and economic goals.

While signals that government may bring forward regulation to require a minimum energy performance for properties placed on the rental market. However, for this to be effective it will need to be accompanied by appropriate checks and balances to ensure that the requirement is implemented (non-implementation of existing regulation for EPC and building regs is a significant national problem). Enhanced powers for local authorities to access information on building and home energy performance will be necessary to ensure that compliant landlords are not disadvantaged by those who are less compliant. GM's well established registered landlord schemes present a potential framework to road test the introduction of requirements in homes, and our existing low carbon economic area work programme on commercial and public sector retrofit provides a framework for developing a robust commercial approach. We would be happy to consider partnering with Government on trials and regulation development in this area.

This issues could be addressed via:

Inclusion of an 'infrastructure adequacy' analysis for the siting of new developments, to ensure that they do not have negative indirect implications for road, water and energy infrastructure, and enable low carbon and productive commuting and consumption habits

A requirement for developers to show that properties will have low occupant energy consumption including design and all installed appliances and are suitable for compliance with the carbon targets predicted for the whole lifecycle of the proposed development, including occupancy costs to be built in to the overall cost benefit analysis of site feasibility.

Better alignment between the national policy statements on energy infrastructure and the new national planning policy framework;

Increased transparency and local authority access to energy performance, property and land ownership information, including building regulations information; and

Better enforcement, checks and balances of the application of existing energy standards for new and existing properties, and much higher minimum standards for properties placed on the rental market.

CONNECTED: REPORT 7
LOW CARBON INVESTMENT AND CARBON FUNDING

How do you fund a low carbon revolution?

What are the payback periods and mechanisms?

What impact will the carbon price have?

7.1 CONTEXT

"Ofgem have estimated that we (UK) need around £200bn in generation, electricity networks and gas infrastructure. Of this at least £110bn would be needed in new generation and transmission assets in electricity – over double the rate of the last decade. In a world of global competition for capital, this means increased investment by existing market participants and, in addition, seeking investment from new sources of capital. "(DECC Electricity Market Reform Consultation Document, December 2010).

7.1.1 CAPITALISING ON LOW CARBON INVESTMENT

For GM to secure the investment it needs to deliver on energy challenges it will need to:

Co-ordinate public, private and third sector energy investment strategies and investment partnerships including working with the proposed Green Investment Bank.

Invest in the reduction of energy use and its management. Investment funds will need to be derived in part through a "Pay as You Save" model — a key national and sub regional policy driver here is the introduction of the 'Green Deal' for households and businesses.

Invest in micro generation and supply of heat — driven by the need for energy security and supply; The rising cost of energy and the availability of government subsidy, i.e. renewable heat incentive, Feed-in-tariff.

7.2 CO-ORDINATION

Many low carbon investments are profitable; for example, the returns on some wind generation can be very rewarding, however other technologies are not as familiar to investors, and returns are less certain and pose greater risk to conventional lenders.

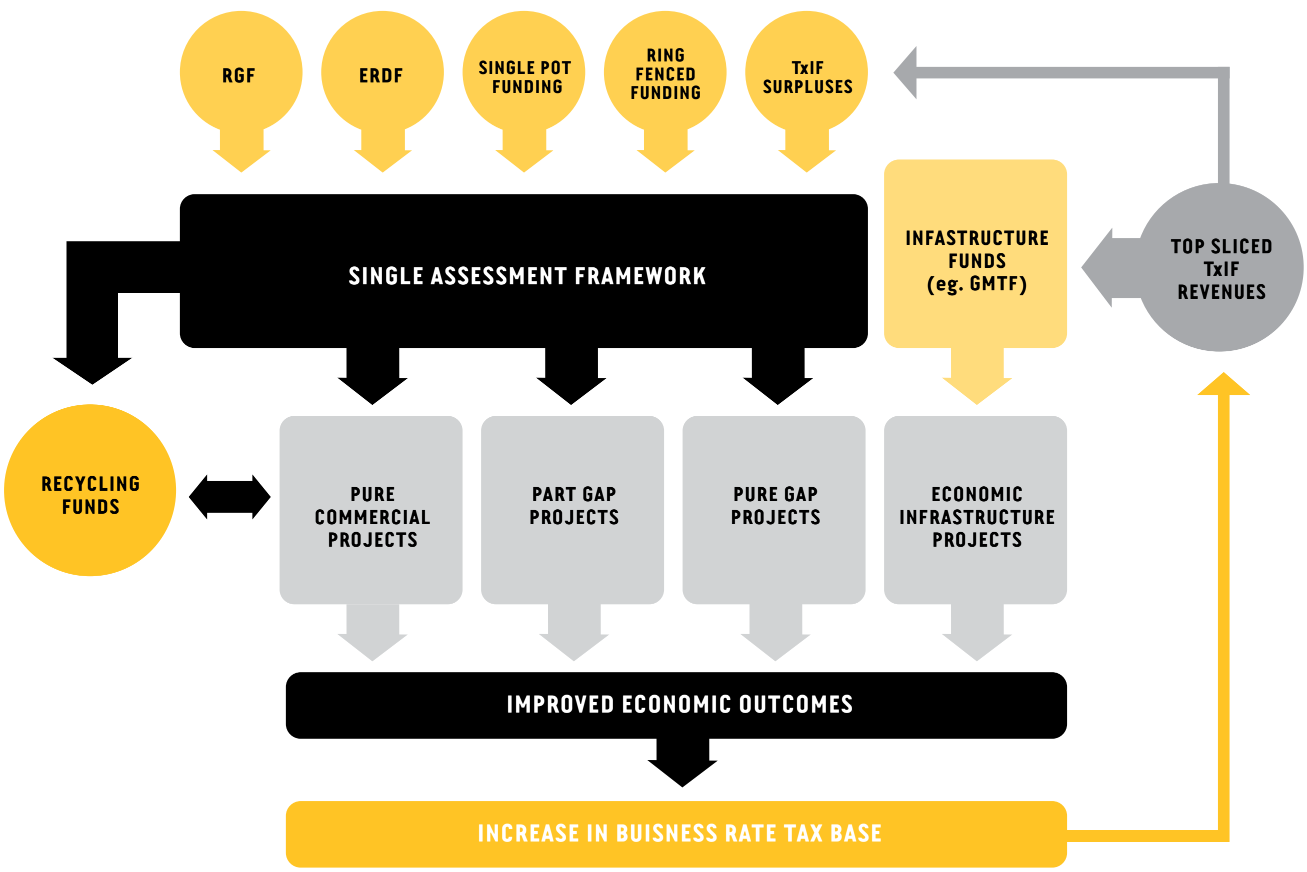
Our aim is to increase familiarity with renewable technologies though investment and demonstration in projects.

There is currently a limited amount of public funds to support or undertake such investment hence Greater Manchester make the infrastructure projects required to deliver this Energy Plan as attractive as possible to commercial investors by reducing risk and uncertainty.

We know that low carbon investment can work through either the ‘monetisation’ of future revenue savings (such as reductions in energy bills) that provides a revenue stream for repayment of capital, or through the generation of output from new energy sources (such as biomass) that can then be sold to contracted consumers. Such projects are often suitable for debt finance, but this is currently scarce in the marketplace mainly due to the absence of tried and tested business models and delivery mechanisms.

Through our procurement leverage in Greater Manchester we aim to minimise risk and provide sufficient scale to generate adequate returns.

Ideally any returns would provide sufficient revenue to pay for a project’s delivery and ongoing maintenance but also to contribute towards a central fund to be re-invested in future projects – an “Evergreen2” fund for Greater Manchester. Evergreen2 would fit within the Greater Manchester Investment Framework depicted below.



Evergreen2 would adopt some principles for investment for example seeking;

Increased GVA from the low carbon sector;

A significant percentage reduction in GM carbon emissions;

Strengthening and expansion of local supply chains;

Support for local business growth and start up;

Creation of employment opportunities;

Up skilling of local residents in low carbon skill growth areas.

Where possible private sector investment strategies will be aligned to the overall objectives of this GM Energy Plan. Learning will be shared between investors, projects and partners, using protocols, to develop the best finance models appropriate to GM's needs. Projects may also be delivered by the co-operative or community enterprise sector, as far as possible being self-financing.

GM aims to align its low carbon investment strategy with that of the Green Investment Bank. The GIB may need to use smaller intermediaries to distribute more standardized smaller ticket products to a broader customer base which could involve working with other banks and could contract out part of the investment management function to a private sector asset manager. We need to align GM's low carbon investment framework with these plans to ensure synergy and avoid duplication.

A team of investment specialists has been put in place to further develop and implement the Evergreen 2 approach to securing investment for major GM programmes. The GM Investment Team has low carbon projects as a core priority within its portfolio.

In support of this work, a range of scheme specific business models has been developed to support local authorities and other key organizations in implementing retrofit, demand reduction, heat and energy schemes, and a portfolio of brochures outlining GM's low carbon investment potential was published in June 2011.

7.3 INVESTMENT IN THE REDUCTION OF ENERGY USE AND ITS MANAGEMENT

7.3.1 GREEN DEAL

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 CO2.

In order to meet targets for energy and carbon reduction the existing housing stock must undertake a wholesale transformation process to become more thermally efficient and to utilise low-carbon sources of energy.

It is estimated that capital expenditure well in excess of £8bn will be required over the next 20-30 years. Some Green Deal type measures such as loft insulation and cavity wall insulation are effectively self-financing (i.e. the costs of installing these is more than repaid through the fuel savings in less than a year or two), but many measures such as solid wall insulation have a much longer payback period and will require some form of economic support.

The national policy driver for this activity is the Green Deal though this will not be fully in place until autumn 2012; in GM we are developing a Green Deal Strategy and Action Plan.

GM is a 'Green Deal Trailblazer' which will test out 'Pay As You Save (PAYs)' at scale. There will be a balance between individual property related PAYs, energy efficiency work which is supported through rents, utility company obligation funding, and other funding sources (or flexibilities) which can pump-prime this activity along with exploring the potential to draw in the Evergreen investment fund.

GM is developing Green Deal strategic partnerships, for example for a pilot solar Pv installation with a consortium of registered social housing providers.

A number of community-led initiatives are emerging, e.g. carbon co-ops where residents come together to retrofit their houses through the purchase of low-carbon and energy-saving equipment re-investing any surplus into the co-op.

7.3.2 PUBLIC SECTOR AND COMMERCIAL ESTATE RETROFIT

There are substantial energy efficiencies to be made from improvements within public and private sector commercial and industrial estates.

The ten Greater Manchester Local Authorities are pursuing individual energy efficiency and retrofit projects and are also exploring the options for their future procurement. Each Authority has undertaken retrofitting to varying degrees to date but not at a combined GM scale. Investors such as the European Investment Bank and Deutsche Bank, programme managers of the European Energy Efficiency Facility (EEE – F) are seeking to lend to innovative projects.

A number of delivery models may emerge depending upon the preferred solution including Energy Performance Contracting, Special Purpose Vehicles and joint delivery teams.

7.4 INVESTMENT IN MICRO GENERATION AND SUPPLY OF HEAT

A number of potential energy or heat sources have been identified including CHP (gas or biomass); smallscale hydro, energy from waste.

These schemes will be delivered if they are commercially viable they rely on their ability to obtain sufficient customer demand and secure revenues to repay initial investment.

Without compromising their independence of delivery, it would be helpful to have a central GM source of information on the scale and scope of these individual micro projects and the key players in the industry. This would also help to determine the supply chain. This information could be gathered fairly cost effectively through existing sources.

GM HEAT NETWORKS

The AGMA Decentralised Energy Study identified the opportunity for heat networks in GM to supply heating and cooling to existing and new developments across the conurbation. Individual authorities have been identifying schemes since completion of the study in June 2010 and these are now being co-ordinated to develop a bundle of schemes that can be soft-tested by the market.

Schemes include Manchester Town Hall Cluster, Stockport Town Centre, Bury Pilsworth, Oldham Heat Network and Bolton Heat network. The UK heat network market is relatively immature compared to Scandinavia and North America. In GM experience to date is largely based on 1970s schemes typically built to deliver social benefits to tenants.

A dedicated CHP plant with a heat network will have relatively high capital costs and must deliver at scale to large numbers of properties and ideally those properties to be of medium to high heat density in order to reduce costs per household supplied.

To be competitive the business models must be based on a low (5-10%) but long-term return for 20 years or more to gets costs to consumers down and make the heat offering attractive. This will rely on a contracts-based system and is at odds with a competitive energy market predicated on the ability of consumers to switch suppliers.

Heat networks are currently not recognised by, or within the mandate of the energy regulator, OFGEM. This creates investment risk.

Many heat networks are operated at near marginal cost, resulting in a significant barrier to entry for heat network providers.

The introduction of the renewable heat incentive will overcome some of the marginal cost issues. In the firstmphase, long-term tariff support will be targeted in the non-domestic sectors, at the big heat users – the industrial, business and public sector – which contribute 38% of the UK's carbon emissions.

The second phase of the RHI scheme will see it expanded to include more technologies as well as support or households. This transition will be timed to align with the Green Deal, which is intended to be introduced in October 2012. (DECC)

Although challenging to deliver, GM will continue to pursue the possibility of implementation of heat networks as they address social issues including fuel poverty and energy security in a more integrated way, providing the potential for a lower total cost of energy delivery and higher useful energy yield than conventional onsite power and gas consumption.

7.5 GREEN INVESTMENT BANK

The Green Investment Bank is being established by the UK government to address market failure in the range and availability of financial products available to support low carbon infrastructure projects. Once state aid approval is granted, it will be established under the Companies Act within a legislative framework which confirms its independence. Initial funding of £3 Billion has been announced by Government. The GIB is currently being established and in its first phase will make direct investments in the green economy. GM is seeking to influence the design and delivery arrangements for the GIB to ensure that they align with GM's investment, low carbon and wider economic priorities.

7.6 CORE INVESTMENT CRITERIA

The government has produced national carbon budgets to meet the provisions of Climate Change Act (2008). A 'carbon budget' is a cap on the total quantity of greenhouse gas emissions emitted in the UK over a specified time.

Carbon has a minimum value or price set by the government, a £/tCO2e which is estimated to rise from £14/tCO2e to £70/tCO2e by 2030.

Investment in renewable and de-centralised energy projects can be driven by the need to avoid costs arising from compliance with CO2 reduction targets for example the Carbon Reduction Commitment (CRC) scheme.

The integration of carbon pricing and energy costs into investment decision-making, and, where appropriate, the understanding of other long term climate change is key to making robust long term investment decisions. Forward looking organisations such as the Co-operative Group have pioneered a range of ethical investment criteria across their investment and operational portfolios. The integration of low carbon and energy conscious criteria into GM's investment decisionmaking is key to delivering a low carbon energy future, and a methodology for use by GM's authorities is currently under development.

7.7 ACTIVE PRIVATE SECTOR INVESTMENT

In parallel with work to identify investment for key energy infrastructure projects, a range of investments are being made by major private and public sector organisations across Greater Manchester. The models developed for scheme delivery are being analysed to identify opportunities to increase private sector investment activity, and to learn from the models used in successful schemes.

Examples of major private sector investment include:

A cc £500 million programme of network improvements being undertaken by Electricity North West between now and 2015. The Greater Manchester Energy Group will support Electricity North West in ensuring that the 2015 to 2023 programme aligns with this Plan's priorities and GM's ambitious carbon reduction and economic targets.

A range of property portfolio improvements being undertaken by companies such as Bruntwood and Peel, including energy networks at mediacity, trigeneration facilities at Granada studios.

Innovative power contract development for geothermal opportunities in Manchester, and a biogas generation and distribution scheme in Stockport.

Long term energy upgrade and services agreements across GM's NHS and Hospital Trust Estates

A comprehensive university estate programme to use in house academic expertise to inform the design and deployment of low carbon energy infrastructure

Energy generation (biomass) and efficiency investments being integrated into the Co-operative Group's NOMA headquarters, as well as a range of energy generation investments such as wind farms already in place across the UK.

CONNECTED: REPORT 8
WORKING TOGETHER

8.1 **GOVERNANCE**

The ten authorities making up Greater Manchester were the first in the country to take on Combined Authority status on 1st April 2011. The Combined Authority will take on devolved powers for transport, planning and economic development, and has developed a shared Climate Change Strategy. The Combined Authority will work with Greater Manchester's Local Enterprise Partnership to be a driving force for change and to provide a single point of contact for investors, utility providers and other key energy organisations.

Greater Manchester is developing capacity to deliver cross boundary low carbon projects. The advantage of ten local authorities working together with the private sector allows for increased project development capacity, single points for contact for the private sector, economies of scale, knowledge transfer and less duplication of effort. Working together across Greater Manchester enables a scale of activity that warrants the attention of significant national and international investment, and a collective influence that secures the attention of policy and decision makers.

Greater Manchester's unique governance arrangements have prioritised energy and low carbon issues from the earliest stages of its development. The Greater Manchester Environment Commission was one of the first to meet in 2009 and the Energy Group was established shortly afterwards. Against a landscape of rapidly changing legislation, market reform and challenging economic times this strong, cross party political agreement on energy priorities provides a stable platform for businesses, investors and government to confidently invest and engage in delivering Greater Manchester's low carbon energy future.

8.2 **INTRODUCTION**

The Greater Manchester Environment Commission's work programme has five themes; Buildings, Energy, Sustainable Production and Consumption, Transport and the Green and Blue (natural) environment. The Energy Group progresses the Energy themeThe programme is supported by a shared team of people across all five themes– the Greater Manchester Environment Team. Links to the ten local authorities and other public sector organisations in Greater Manchester are maintained via a Chief Officer's Group of senior staff led by the Environment Commission's Lead Chief Executive, Charlie Parker and by the Environment Commission itself, reporting to the Association of Greater Manchester Authorities (AGMA) Executive.

8.3 **ROLES AND RESPONSIBILITIES**

The roles and responsibilities of the key organisations are:

AGMA	To develop an overarching Climate Change Strategy and Energy Plan and co-ordinate activities to ensure maximum benefit is obtained for Greater Manchester, both in terms of economic growth opportunities and delivering a secure, affordable low carbon energy system.

Environment Commission	The Environment Commission's remit is to oversee the planning and delivery of Greater Manchester's environmental work programme, and the Greater Manchester Strategy's low carbon strategic priority. It comprises 6 elected members, 5 appointed members selected on the basis of their thought leadership on environmental issues, and a range of advisers selected from organisations with key accountabilities for Greater Manchester's environment. Its current Chair (November 2011) is the Leader of Stockport Council, Dave Goddard, who represents the Commission on AGMA's Executive.
Greater Manchester Energy Group	The Energy Group is an established partnership of organisations who work closely together to deliver a secure, low carbon energy system and strong energy sector economy for Greater Manchester. The first of its kind in the UK, the Group provides a highly useful sounding board for government policy development, understanding the practical implications of policy measures and informing the resolution of policy and market barriers to common community energy problems. The Group comprises generation, distribution and other organisations with a key role to play in Greater Manchester's energy system. The Group is a forerunner for localism principles, with key local organisations voluntarily collaborating to jointly identify and act on energy priorities. The UK energy market is a highly complex, segmented and regulated system, and it is important for the Group to clarify and support GM's role and interactions with it. AGMA Executive approved the establishment of the Greater Manchester Energy Group in May 2009, and finalised its purpose, remit and scope in December 2009. Its first full meeting was in April 2010. It meets bimonthly. The Group has operated since April 2010, during which its primary benefits have been to establish a sense of partnership and trust between organisations involved in different aspects of the energy and low carbon agenda, and to produce this Plan. The Energy Group has supported its members in developing corporate and organisation projects, proposals and plans, communications activities and events for key strategic issues. It has successfully secured funds for partners from third parties to deliver on mutual energy objectives, and has increased partner understanding and awareness of their respective contributions to Greater Manchester's energy system, including how to access our substantial (£100m+) energy research base. In addition to the strategic role, this has also expedited the resolution of local incidents and issues, and helped identify key actors and solutions. Clear mandates are required to ensure the energy market delivers a secure, low carbon, affordable energy future for Greater Manchester. **Local Authorities** lead on the delivery of low carbon schemes within their own boundaries, using public sector procurement capacity and the public estate to stimulate supply chains and ensuring that their strategies and local development requirements achieve the timely delivery of low carbon development and infrastructure. The **Local Enterprise Partnership** ensures that private investment and business development is influenced by the

	Climate Change Strategy. It is represented on the Energy Group to help ensure that Greater Manchester's economic and enterprise actions are informed by and aligned with the challenges of delivering a low carbon, affordable and secure energy system. **Energy companies** ensure secure energy supplies for Greater Manchester, facilitating growth, managing demand and developing Smart grids to maximise the benefits of decentralised energy production.
Business support organisations	It is widely recognised that changes in the ways that energy consumers behave are of vital importance in reducing carbon emissions. This agenda is currently funded by government and delivered through The Carbon Trust and Energy Savings Trust (EST). EST delivers a series of demand reduction programmes aimed at individual consumers through an advice centre network, a website and community events. The Carbon Trust provides specialist support to help business and the public sector boost business returns by cutting carbon emissions, saving energy and commercialising low carbon technologies. Business support is also in place via Business Link, and a range of support currently funded by the NWDA and local authorities. In Greater Manchester the European award winning 'ENWORKS' programme provides a leading-edge package of resource efficiency and business support using a highly innovative project opportunities, impact and evaluation monitoring software. This has significant potential for application in other cities and businesses. a Business Pledge system to support low carbon and energy demand reduction activities is in place. Chambers of Commerce also provide support to businesses and the Greater Manchester Chamber operates a Carbon Reduction Group. Significant changes to the business support environment are taking place at both national and local level. A strategic growth hub is being put in place to support growth across Greater Manchester, and there is a strong recognition in its development of the importance of this sector both to delivering the infrastructure to underpin sustainable growth and its prospects for directly contributing to growth. The hub will work with the Environment Commission and AGMA to identify the best way to assist businesses in accessing low carbon economy opportunities, and support them in cutting their carbon emissions and energy usage.

Greater Manchester plans to:

Review the structure of the Environment Commission and membership of the Energy Group to reflect the strategic growth hub, and changes in national agencies and secure participation from key strategic and delivery partners.

Further develop the roles of the GM Environment Team, strategic growth hub and other key organisations in providing coordination and support to the Group and its members, including the development of project task and finish groups and private sector partnerships to take forward priorities.

Work with the Environment Commission and Local Enterprise Partnership to ensure that key energy actions are central to Greater Manchester's Climate Change Implementation Plan and wider economic growth priorities.

CONNECTED: REPORT 9
ACTION PLAN

A range of planned actions and initiatives are described throughout the report. However, aligned with developing GM Climate Change Strategy and Implementation Plan, this table provides a brief summary of the 8 headline energy actions GM intends to undertake between now and 2015.

Action	Measure
Have developed a Greater Manchester Low Carbon Hub Investment programme which has delivered significant numbers of public sector buildings projects across all ten districts.	Scale of investment and CO_2 savings will be reported through AGMA and GMCA
Established effective mechanisms for delivering robust energy generation projects and infrastructure and for understanding the impact of our actions on climate, resource efficiency and economic performance.	AGMA / GMCA structural and planning reform initiatives
Deployed a 'capacity to customers' pilot programme that incorporates smart networks and metering, local energy storage, demand management and price signalling. This will seek to substantially increase the available capacity of the existing electricity grid without the need to install significant new cable infrastructure.	ENW reporting
Developed specific proposals for heat networks, energy generation from renewables and building-scale renewable heat models, which, by 2020, would result in the local / locally owned low carbon generation of 3TWh of heat and 1TWh of electricity per annum.	Via DECC datasets
Through Electricity North West, completed a £500 million programme to strengthen our distribution infrastructure and drafted an energy system balancing plan for GM.	Electricity North West reports
Increased the amount of electricity procured from renewable resources to 20% of GM's commercial requirements and, subject to feasibility, started to offer energy tariffs to customers that retain economic benefits within GM.	Evaluation of key partner and large user procurement contracts.
Released £100 million per annum that would otherwise be spent on energy generated outside Greater Manchester could be available to the GM Economy by combined demand reduction and local generation and supply activities.	Impact analysis of energy demand reduction, switching, smart grid and local generation schemes and initiatives
Increased the energy research presence of GM's academic institutions from £100 million to £150 million per year and substantially increased collaboration between research and GM applications.	University research income

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AGMA ASSOCIATION OF GREATER MANCHESTER AUTHORITIES

nwIEP north west improvement and efficiency partnership