GREATER MANCHESTER INDEPENDENT PROSPERITY REVIEW

EVIDENCE UPDATE: CARBON NEUTRALITY

A research report for the
Greater Manchester Prosperity Review: Evidence Update
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Greater Manchester Combined Authority Research Team produces high quality research and intelligence to form the evidence base underpinning policy and strategy for the city region.

The Greater Manchester Independent Prosperity Review was commissioned by a panel of distinguished experts, chaired by Professor Diane Coyle, to provide a detailed and rigorous assessment of the current state, and future potential, of Greater Manchester's economy. Commencing ten years on from the path-breaking Manchester Independent Economic Review, it provides a fresh understanding of what needs to be done to improve productivity and drive prosperity across the city region.

This latest update, the Greater Manchester Independent Prosperity Review: Evidence Update is a key part of the sustained work done by researchers at the Greater Manchester Combined Authority – with input and challenge from experts. The update explores seven inter-connected thematic areas: carbon neutrality, health inequalities, productivity and the business base, the labour market, skills utilisation and employer investment in skills, trade, and transport in light of the significant economic developments experienced since 2019 (Covid-19, UK's exit from the European Union and the energy and inflation shock).

This report, alongside the six other research reports on the thematic areas listed above, forms part of a suite of work from which the summary, the Evidence Update: Reflections Report is drawn. The evidence update will be used to inform the refresh of the Local Industrial Strategy.

Contents

Executive Summary

Three years on from the Greater Manchester Local Industrial Strategy (LIS) (GMCA, 2019a), the context has radically changed with Covid-19, the EU Exit and the Glasgow-hosted COP26 UN climate conference heightening attention on the climate crisis. The LIS set out a bold mission on the climate crisis back in 2019 – with the ambition to achieve carbon neutral living in Greater Manchester (GM) by 2038, launching the UK's first city-region Clean Growth mission. The Greater Manchester Strategy (GMS) (2016-2020) 'Our People, Our Place' (GMCA, 2016), positioned a green city region as one of ten priorities. In the refreshed GMS, published in December 2021 (GMCA, 2021), a carbon-neutral Greater Manchester is one of the strategy's shared commitments, reinforcing that collective action is necessary to achieve carbon neutrality. By the end of 2020, all 10 Local Authorities within Greater Manchester, along with Greater Manchester Combined Authority (GMCA) had declared a climate emergency.

The Prosperity Review Panel provided a strong steer that in delivering carbon neutral living, the city region should aim to maximise benefits to the economy, health and quality of life. They recommended that we focus on those environmental improvements which would be of direct benefit to Greater Manchester residents such as improving air quality and housing as well as providing other environmental benefits, such as easy access to green space and urban planting (GMCA, 2019b). Despite progress, urgent action, together with innovation, is still needed to bring us closer to achieving this ambitious target by 2038.

This paper draws on evidence across multiple policy areas to understand the challenge around net zero carbon in Greater Manchester, including evidence around the progress made towards the city region's carbon neutrality target, the level of investment needed to achieve this goal, and on previous work completed by the GMCA's Skills Intelligence Team around understanding the "Green Economy". The full Skills Intelligence report for Green Economy can be found here and draws on literature, data and intel from employers, sector bodies and training providers operating in Greater Manchester.

This paper identifies the following key findings:

- Greater Manchester has an ambitious target to be carbon neutral by 2038. The scale of the challenge is increasing year on year as emissions remain greater than the required levels that would align with a carbon neutral pathway. The biggest opportunities for achieving net zero lie in fast and deep carbon emissions reductions, particularly in relation to buildings and transport, the two sectors where emissions are highest.
- Primarily, reaching carbon neutrality requires residents and business to reduce resource consumption. This presents opportunities for new business models, new skills and training for employers, innovation and the growth of economic sectors to facilitate the transition to net zero carbon, and improved quality of life and collective purpose for residents. Aligning with net zero will provide an economy decarbonised from fossil fuels and carbon emissions but will also provide growth opportunities for new industries and jobs.
- A transition to net zero carbon will impact most sectors, but this will be to varying degrees. Human-based sectors like education, health and social care, or hospitality will see less change, whereas sectors like construction, manufacturing, and logistics will see big changes. Carbon-intensive jobs will be phased out but provide a potential opportunity for retraining into 'greener' jobs in high demand low carbon sectors. Jobs in the 'natural environment' will be crucial to support the adaptation and resilience of Greater Manchester to respond to climatic stresses that we are already experiencing, such as flooding and high temperatures. These changes within the employment base demand attention to secure a 'Just Transition', ensuring workers currently holding carbon-intensive jobs and those from historically marginalised communities are the first to benefit from the green jobs the net zero agenda creates.
- Simultaneously, job roles within traditional low carbon industries are often in highly technical occupations as much of the shift to net zero carbon will involve improvements in (energy) infrastructure, transport, consumer habits, and business practices. Decarbonisation is subsequently one of the biggest shifts the economy will undertake since the industrial revolution.

- The pursuit of a net zero carbon economy will require investment in existing and new sectors. The level of investment needed in relation to the energy system alone in Greater Manchester to reach 2038 carbon neutrality is £64bn, with £6bn of this required by 2025. Approximately 70% of this would be required under 'business as usual' scenarios. Novel commercial models will need to be developed to help deliver this level of investment.
- No/low-regret net zero options[1] must be considered in the immediate short term in order to maintain aspirations for a carbon neutral Greater Manchester by 2038. Policymakers need to acknowledge and support those who may be adversely impacted by net zero to ensure progress does not exacerbate inequalities. For example, ensuring that workers in "brown" (carbon-intensive) jobs are considered during the transition is important.
- The current cost of living crisis and energy crisis present incentives, but also additional barriers to the required level of behaviour change that is necessary to reach net zero. The transition to net zero carbon is therefore as much about reducing inequalities as it is reducing carbon emissions. Reaching our net zero ambition will only be possible if it is inseparably linked with combatting economic and social inequalities.

[1] Such options are those that regardless of wider socio-political changes that may be unknown at present, these activities will generate positive outcomes, compared to the initial cost of implementing them, for example, fabric retrofit of properties which will reduce energy demand regardless of the source of energy.

Introduction: the scale and urgency of the net zero carbon challenge

1.1 Taking shared actions to reach net zero carbon is critical at a local, national and global level in order to hold global mean temperature increases to well below 2°C[2] as agreed in the 2015 Paris Climate Agreement, a level of relative temperature rise that avoids the most dangerous climate impacts that would endanger the critical earth systems that our societies and economies rely upon. In 2018, Greater Manchester set a target to be carbon neutral by 2038[3] - a science-based target that enables the city-region to make its 'fair and equitable' contribution towards international climate agreements (GMCA 2019c, Kuriakose et al. 2018) – a contribution that reflects historic responsibility over emissions, and a greater ability to act on emissions reductions.

1.2 Figure 1 shows progress to date against the 2038 carbon budget (set at 67million tonnes carbon-dioxide ($MtCO_2$) for the period 2018-2038). Since 2018, GM's emissions are cumulatively 9.9$MtCO_2$ above where they should be against the budget. At current (2020) emission rates, GM is only 4 years away from using up the entire 2018-2038 carbon budget. The majority of GM's emissions (71%) result from travel and transport around the region, and from powering and heating our homes.

[2] The UNFCCC Paris Agreement, is a legally binding international treaty on climate change, adopted by 196 Parties (nations) at the COP-21 conference in Paris in 2015. It's goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

[3] Reference is made throughout this report to "carbon neutral" and "net zero carbon". Multiple definitions of these terms (and others often used in their place) can be found in research and policy, and they are at times used interchangeably (see Kuriakose et al 2018). For this report, we use the term 'net zero carbon' when relating to the wider UK and global context, and 'carbon neutral' when referring to the specific goals of Greater Manchester, as set out in the Five-Year Environment Plan.

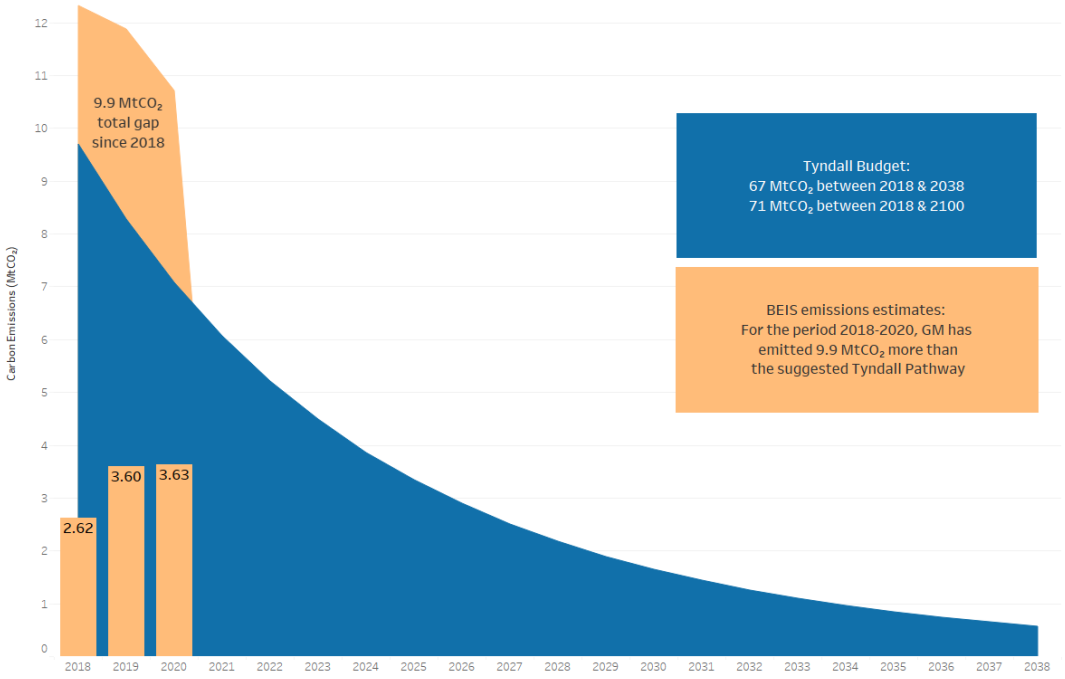

Figure 1. Greater Manchester's carbon emissions (since 2018) compared to the suggested pathway to a carbon neutral city-region in 2038. Blue carbon budget from the Tyndall Centre, and actual emissions estimates from BEIS (2022)

1.3 Since 1990, the UK has reduced greenhouse gas emissions by 44%, whilst the UK economy has grown by over 75% (BEIS, 2021a). A large proportion of this reduction has resulted from the historical decarbonisation of the national grid, which has resulted in GM's annual emissions reducing from 18.66$MtCO_2$ in 2005, to 10.71$MtCO_2$ in 2020 (a 43% reduction)[4]. Whilst emissions sources closely aligned with the national grid show the greatest reduction (such as industry and commercial activity), others show much lower levels of reduction: in the same period, emissions from transport have only reduced 25% (from 5.4$MtCO_2$ in 2005 to 4$MtCO_2$ in 2020).

1.4 Failure to deliver net zero carbon will incur major long-term economic, social, political and environmental costs. The delay in action will most likely impact those that are least able to pay for it. The Office for Budget Responsibility (OBR, 2021) forecast that reaching net zero emissions in the UK will cost

[4] Analysis of Local Authority Emissions Estimates, BEIS (2022).

£489bn by 2050, which is less than the 2008 financial crisis, and the Covid-19 pandemic response. Delays to addressing emissions could double this cost: the earlier action is taken, the lower the financial implications will be.

1.5 To deliver the required level of action – that is to reduce emissions in line with Greater Manchester's budget trajectory, but also to recover the 'overspend' of 9.9MtCO_2 – there needs to be systemic change. Reaching carbon neutrality by 2038 and increasing our resilience to changes that are already happening within the climate system requires new approaches across all aspects of society and the economy. This is not only in respect to renewables, or ecosystem restoration, but also in carbon-intensive "brown" sectors like transport, logistics, manufacturing, and construction. The relationship between net zero carbon and the economy is therefore two-fold: a specialist 'net zero' sector is required to support achieving net zero, whilst simultaneously all sectors – frontier and foundational – will need to transition to operate as net zero.

1.6 Greater Manchester is one of several city regions working to achieve net zero carbon, with networks such as C40[5], a group of mayors from nearly 100 cities around the globe, enabling sharing of best practice and commitment to address these challenges. As part of the refreshed Local Industrial Strategy evidence base, Alliance Manchester Business School (AMBS) has also undertaken exploratory work into international best practice around these challenges, and reviewed three different city-region approaches: Amsterdam, the Basque Country and Washington D.C. The report[6] highlighted both the role of frontier and foundational sectors in achieving net zero, and the potential for innovation to diffuse between these sectors.

1.7 Reducing Greater Manchester's emissions and reaching carbon neutrality by 2038 requires technological innovation in technology, finance and delivery

[5] C40 is a network of mayors of nearly 100 world-leading cities collaborating to deliver urgent action on climate change. See: https://www.c40.org/about-c40/

[6] The report "Towards Green and Just City Regions" is available alongside the other six GMCA research reports as part of this evidence update, and also available at https://www.policy.manchester.ac.uk/what-we-do/gm-policy-hub/reports/

mechanisms as well as investment in research and development, skills development, together with wider economic and lifestyle changes. There remain wider policy drivers and challenges to consider. The transition to net zero carbon is fundamental for addressing the climate crisis, but also presents the opportunity for a green and fair recovery from the pandemic. Ensuring that the transition doesn't worsen inequality is critical; it will be important for policymakers to be mindful of this when considering both the opportunities (i.e. skills development and high paying jobs) and the financial costs (i.e. expensive low-carbon infrastructure). Moreover, net-zero can support the reduction of existing inequalities, for example through reducing fuel poverty, or incentivising public transport use through reductions in fares.

1.8 Whilst activities linked to carbon reduction, such as domestic retrofit, are positioned as a response to achieve net zero carbon, they currently help address other societal challenges. 2021 marked the start of unprecedented increases in the cost of energy. The UK's domestic default tariff price cap[7] for energy has increased from around £1,100 in Winter 2018/19 to £2,500 in October 2022[8]. Previous forecasts by Cornwall Insights (2022) predicted bills would have risen to over £4,000 in January 2023 without Government intervention. Improving a property's energy efficiency and installing low carbon heating technology, where suitable, may well provide financial as well as carbon benefits. Going forward it will be vital to ensure that sectors within the Foundational Economy are supported such that they both demand and have access to a supply of employees with the appropriate skills (eg in construction/retrofit) to support the challenge of net zero and, in parallel with

[7] The default tariff price cap, set by Ofgem, is based on the national average annual bill for customers paying by direct debit, assuming annual consumption of 2,900kWh of electricity and 12,00kWh for gas. From October 2022, the price cap will be reviewed every 3 months.

[8] In September 2022, in response to increasing energy costs and cost of living pressures, the UK Government announced the 'Energy Price Guarantee' that meant a typical UK household would pay energy bills of £2,500 per year for the next two years.

this, support poverty reduction through higher skill levels and associated increased wages.

1.9 Delivering net zero carbon is not just a technical challenge. Understanding how wider societal and behavioural changes impact on emissions reductions will be crucial to meeting net zero aspirations. Social norms influence consumer activity: the local economy has a role to play in shaping the direction of change through the provision of options, affordability, and confidence in net zero market activity. A Government Office for Science project – A net zero society: scenarios and pathways[9] - is currently exploring different scenarios of future societal and behaviour changes relating to energy demand and emissions and is due to report on findings late 2022.

1.10 Through technological innovation and scaling-up (demand aggregation), cost barriers to net zero will reduce; yet other co-benefits and trade-offs will exist. Where, and how significant, these co-benefits and trade-offs are positioned in pursuit of a growth agenda, whilst attaining for green, fair and just transitions must be considered. Is pursuing 'green growth' sufficient? When do green priorities need to be placed ahead of economic priorities, or equally, when do economic priorities get pursued above green? And crucially, who bears the cost of the required investment? To achieve GM's carbon neutral ambition, there is a need for the whole economy to operate in a manner that is supportive of carbon neutrality (and wider ecological limits), to acknowledge and address where this presents challenges to achieve a fair and just transition, and to then identify new opportunities that can be leveraged as a result.

1.11 To address the challenge of delivering carbon neutrality, this paper summarises the available evidence as it relates to the local economy of Greater Manchester, specifically around the challenge of defining green jobs and the subsequent opportunities and challenges presented for the local

[9] Government Office for Science project notice available at https://www.gov.uk/government/publications/net-zero-society-scenarios-and-pathways/a-net-zero-society-scenarios-and-pathways

economy; the changes economic sectors may experience in pursuit of a net zero; the current and potential skills demand presented, and the level of investment required. This paper does not seek to define or provide set conclusions of how to achieve net zero, but rather to raise the challenges and questions that will need to be considered in relation to the refreshed Local Industrial Strategy.

Net zero carbon, the economy and 'green jobs'

2.1 Work by the GMCA Skills Intelligence and Research Teams has identified a plethora of methods to define the net zero carbon sector in GM. This report highlights some of these methods, and the challenges presented in defining the sector, but stops short of adopting a particular methodology given the complexities and breadth of the net zero challenge. However, to support the evidence base for this refresh, examples are provided where applicable to the transport and domestic heat and power challenges, given these are currently the largest sources of emissions for Greater Manchester. This section explores some of the issues around what is meant by a "green job" but also where traditional "brown" (carbon-intensive) jobs will need to be greened (Broome et al., 2022).

2.2 In response to the UK Government 'Green Jobs Taskforce' launched in November 2020[10], the Office for National Statistics published a review in April 2021 on the challenges of defining 'green jobs'[11] (ONS, 2021). Measuring the size and make-up of the labour market in the Green Economy is complex and hard to do accurately. This is largely due to how new many of the businesses in the sector are, which means Standard Industry Classifications (SICs) don't capture businesses that many would include in the Green Economy, as well as existing companies within the Green Economy that would identify with traditional SICs, such as manufacturing. A piece of work conducted for the Business Growth Hub in 2018 explored different sector definitions: applying these different definitions gives a wide range of employment number estimates for "green" jobs from 12,653 (EGSS - Environmental Goods and

[10] See https://www.gov.uk/government/groups/green-jobs-taskforce

[11] For brevity, this paper does not repeat the review presented in the ONS report but highlights key findings.

Services Sector), to 53,627 (LCEGSS – an updated an expanded version of Low Carbon Goods and Services) – with an average of around 40,000 people.

2.3 The definitions regularly used are often limited to explicitly "green" occupations – however, to consider the demand and growth of jobs and skills, this scope needs to be wider. Previous work has used GM definitions which bring in wider sector areas which have an important role to play – Greater Manchester's Five-Year Environment Plan (GMCA, 2019) sets out the priority challenge areas as follows:

- Energy Supply – Shifting to renewable sources of energy
- Transport – How we move and transport goods across the city region
- Buildings – Heating the places we live and work
- Resources – How we produce goods and recycle them after use
- Natural Environment – Air, Land, Water and Biodiversity

2.4 Whilst jobs across these five areas are not the sum of the total "green jobs" required, they provide a useful framework for categorising the activities needed to reduce carbon across our economy. PwC has concluded that across the UK, net zero carbon will result in 200,000 job losses, mainly in the repair and servicing of vehicles, but there will be a comparable 400,000 job opportunities created through new activity, for example in retrofit (PwC, 2022). As a result, there is a big opportunity for workers to transfer from declining industries into new jobs – in fact, there are likely to be so many opportunities over the transition, the UK may see a shortfall of workers needed to reach net zero. Currently in some sectors, for example electrical engineering, there is already a deficit of suitably qualified workers. Other economic sectors will also be affected, but to a lesser extent, where more incremental shifts towards a greener jobs profile will be seen (Broome et al, 2022). For example, new roles in finance (as "green" finance options become more popular), consulting, and law. While these roles are not directly related to the sub-sectors above, they are indirectly "green jobs". Similarly, roles in manufacturing for example, which focus on lean and efficient manufacturing reduce waste, energy use,

and resource use – directly green outcomes, but without falling in one of the five sub-sectors above.

2.5 As the labour market shifts more towards these green jobs, there will be sectors that start to be phased out. It is important for policymakers and the skills system to be aware of what these occupations are, and which will need retraining or support over the coming years, for example, gas boiler technicians, and ICE (internal combustion engine) vehicle mechanics. However, these roles will still be required to provide services to consumers who are not able to transition to low carbon alternatives. Comparisons can be drawn with traditional '*vs*' modern mechanics and gas engineers, where systems have digitised over the years; whilst modern digital equipment has required engineers to upskill, there is still a requirement from some members of society for traditional skills. Therefore, support for skills deficits will be two-fold: one through industry upskilling that the market will demand (eg electric vehicle mechanics) and two, dedicated skills training for new technologies that do not yet exist.

2.6 Taking a comprehensive view of the skills needed to reduce carbon across the city region also requires keeping in mind the long-term nature of change. The horizon of the current targets (2038 for GM and 2050 the UK) will include a range of technological changes and policy changes which as a result will impact on the high-demand job roles and skillsets. Many young people currently in the schools and colleges of GM will work in jobs that do not yet exist. Preparing these young people for future jobs requires a focus on STEM, flexible skills and agile mindsets.

Skills demand

3.1. The five challenge areas in the GM Five-Year Environment Plan exhibit skills and labour gaps to varying degrees. Skills intelligence has been gathered from a range of regional and national data sources and, from conversations with groups of employers in all five challenge areas, presented in detail in the Green Economy Intelligence Report (GMCA, 2022). Whilst this gives a good sense of the occupations which will be in high demand, it is difficult to assess the scale of demand with any certainty. The type of occupations in demand are covered below and summarised in Table 1.

3.2. Demand for net zero carbon skills and labour in the economy is significantly led by policy and government subsidy. Development of the Greater Manchester Local Energy Market will enable energy generators and end users to access a more flexible and integrated market. Work on the retrofitting of homes, commercial property, and the public sector estate across Greater Manchester will accelerate with the continuation of the Green Homes Grant in GM, the launch of the government's Boiler Upgrade Scheme, and the launch of the Retrofit Accelerator in 2022 (GMCA, 2022a; BEIS, 2021b). Ongoing rollout of the IGNITION project outputs aim to develop funding solutions for investing in GM's Natural Environment (GMCA 2021a). Planned expansion of the Bee Network will see thousands of miles of additional walking, cycling, and bus routes across the city region (TfGM, 2021).

3.2. **Low Carbon Buildings** - Homes and other buildings will need various measures to ensure that the city region can reach net zero carbon. Of particular importance are the decarbonisation of heat, improvements to energy efficiency and electrification. Employers reported that the existing workforce would need additional skills. Low-carbon heating systems like heat pumps, often need the installer to accurately size the power and size of the unit for the property, which is not part of the role for gas-based systems. Much of the work of a gas engineer is maintenance and replacement of like-for-like systems – low carbon heating systems require additional varied skills.

Employers reported that skilled workers in the more advanced skillsets are often hard to find, and the GM Retrofit Action Plan (GMCA, 2022a) estimates a shortfall of around 7,000 – 8,000 construction workers over the next five years if construction and retrofit trends continue to grow. Highly skilled low carbon engineers will be crucial to provide consumers with confidence to switch to low carbon heating sources.

3.3. **Transport –** With around 44,000 people employed across the sector, some parts of the city region's transport ecosystem have already begun to shift towards net zero carbon, in line with the goal of the 2040 Transport Strategy to protect the environment. Both electric vehicle (EV) adoption and public transport availability are increasing and, with these, the occupations in demand are changing. Some immediate skills demands are from EV infrastructure installers – both domestic and commercial charging points. This can largely be done by existing qualified electricians but, in some cases, they need additional qualifications to install some systems. As infrastructure and manufacturing starts to decline as mass adoption takes hold, the importance of maintenance and repair professionals will increase. While the motor of an EV is very different to a combustion fuel engine, the other parts of the car will largely stay the same – mechanics will see some change in their roles, but at a relatively slow pace as older cars are retired. Rail and light-rail engineering and electrification already see acute skills and labour gaps. With public transport expected to play a big role in the drive towards net zero, combined with large upcoming infrastructure projects like HS2, training more rail and electrical engineers will be crucial.

3.4. **Energy** - Electrifying heating, transport, and industrial systems will put additional pressure on the wider power grid. Ensuring that the grid adapts to the additional demands is a huge part of the shift to net zero carbon. This is the responsibility of the National Grid and the Distribution Network Operators (DNOs), so skills gaps within the relevant companies and occupations must

be addressed. By 2040, Electricity North West Ltd's (ENWL)[12] "Best View" scenario estimates annual electricity demand rising by around 65% (23TWh to 38TWh) and renewable generation capability rising by 243% (1.48GW to 3.6GW). Their Business Plan anticipates a requirement of "145 additional DLO (operational) staff and up to 580 contract staff". This workforce will need engineering and maintenance skills – these are delivered currently through the Level 3 Power Network Craftsperson apprenticeship. In addition to these direct network staff, GM has around 5,000 – 6,000 electricians working on domestic/commercial properties, many of which will need to adapt their skillset to support different tasks (setting up net zero technology like solar panels, batteries, and smart power systems).

3.5. **Resources** - The shift to net zero combined with the ongoing need to reduce waste and production of non-recyclable materials will demand greater consideration of resource use. This includes ensuring that the products and services we consume have resource reduction and net zero embedded from their inception, alongside wider recycling and circular economy solutions. Employers reported that much of the process of sorting waste is now automated, so there are very few direct skills requirements. Understanding what waste is recyclable, non-recyclable, and usable for energy plants comes with experience and is largely left to specialised machinery. Employers reported some fleet management skills requirements, given many large employers in the sector collect waste in large vehicles.

3.6. **Natural Environment** - The management of rural and urban environments for the benefit of residents, biodiversity net gain, and the purposes of net zero. Solutions for this area are often referred to as "Nature-based Solutions" (NBS). Full use of NBS will be critical in helping adapt and increase resilience to the climate shocks that Greater Manchester will see over the coming years (i.e. extreme heat, flooding, etc.). There are various skills needs in the sub sector, but jobs in Natural Environment benefit from the perception and the

[12] ENWL is the Electricity DNO in the North West, and is responsible for electricity distribution across Greater Manchester.

feeling of directly impacting the environment (i.e. tree-planting, landscaping). Occupations required include architects, civil engineers, and urban designers, all of whom will need an understanding of NBS and climate resilience. The repair and maintenance of these environments, buildings, and projects is another area of need.

Table 1. Indicative scale of existing workers in each challenge area, along with expected future skills needs

Low carbon buildings	Transport and Infrastructure	Energy	Resources	Natural Environment
Approx. 86,000 Construction workers	Approx. 44,000 Transport workers	Approx. 12,000 Energy Workers	Approx. 6,000 Resources Workers	Approx. 2,000 direct jobs (32,000 indirect)
Heating – (1.2m homes in GM, of which 264,000 Social Housing) Public Sector decarbonisation scheme – schools, council property Retrofitting & construction skills in very short supply Under 1% of workforce accredited MCS or Trustmark In addition, further demand for architects, designers, etc	Introduction of electric buses, further rail electrification EVs and EV infrastructure rollout Additional cycling options Skills of mechanics, construction workers to change	Very little direct power generation in GM Local generation of increasing importance (solar, wind, etc.) Storage and batteries installation Electrical engineering skillsets in v. high demand	Movement towards so-called "Circular Economy" Reuse and repair Responsible disposal of household, commercial and industrial goods Skills in repair, management of recycling sites, awareness, etc.	Emphasis on the deployment on "nature-based solutions" Changing skillset of architects, civil engineers, designers, etc. equally important – approx. 32,000 workers Small direct volume, but important skill shift among other sectors

3.7. Whilst understanding the types of occupations where “green skills” demand is highest is relatively easy, measuring the scale of the need across the wider economy – particularly over time periods during which other sectors will see fluctuating demand – is more difficult. Some sub-sectors benefit from visibility of pipeline. Specifically in Greater Manchester, an example of the scale of opportunity can be seen in domestic retrofit. The Greater Manchester Local Area Energy Plan (LAEP, ESC (2022)) identifies that in the next five years, Greater Manchester will need to install 116,000 heat pumps in homes. Data from MCS[13] shows that since 2015, less than 1,400 domestic air source heat pumps have been installed in the region. As of February 2022, over 90,000 properties in the region had been identified as heat pump-ready (i.e. a heat pump could be installed without any further retrofit measures required)[14]. Understanding the scale of this need allows estimates to be made – the GM Retrofit Action Plan estimates a shortfall of around 7,000 – 8,000 construction workers over the next 5 years if construction and retrofit trends continue to grow.

3.8. However, there will be, and already is, demand for skills relating to net zero carbon across the economy as evidenced by vacancy data. Figure 2 (below) draws from BurningGlass Labour Insights data, which tracks the number of “Green Jobs” advertised online – defined as adverts containing relevant terminology linked to sustainability and green technologies. Comparing the 12 months to July 2022, GM’s green job vacancies were up 108% on the previous 12 months (vs. up 71% for the whole vacancy market). Even over the turbulent months of the pandemic, demand appears to be growing at a faster rate than the wider economy

[13] Data provided direct from MCS (Micro Certification Scheme) and provided up to 31/03/2022. MCS captures around 90% of the market, and therefore provides a good indication of current capacity.
[14] Data provided to GMCA from Octopus Energy. ’Heat Pump’ ready properties were identified as those that with sufficient levels of energy efficiency (through minimum criteria for wall and roof insulation, and windows).

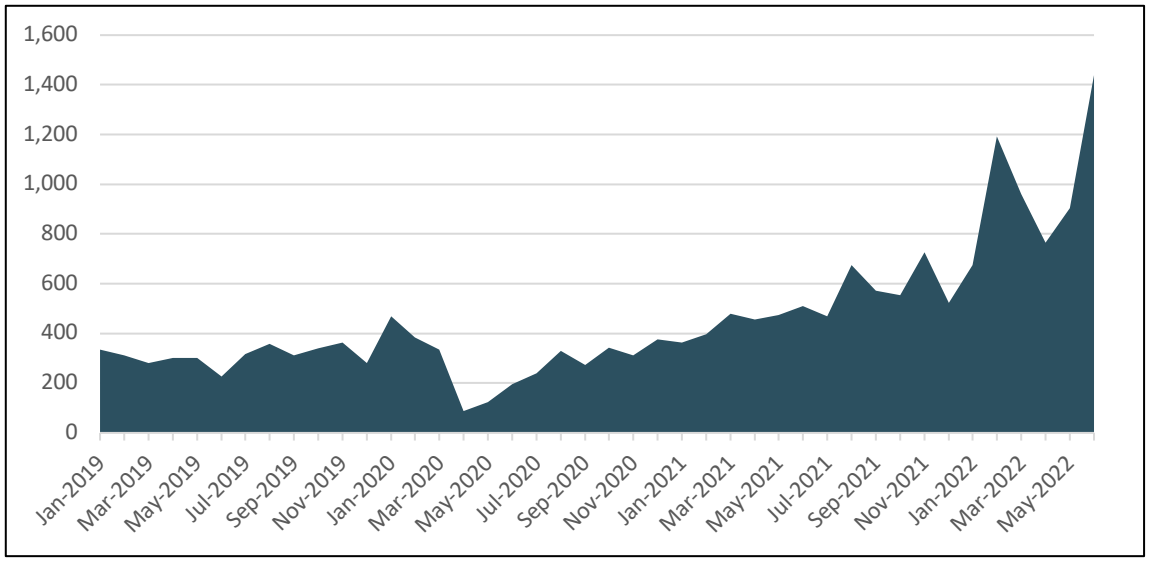

Figure 2. Monthly "Green Job" vacancies in Greater Manchester since 2019.

3.9. The same vacancy data also indicates the types of roles commonly advertised as green jobs. Figure 3 shows that while technical roles feature highly, many of the roles are supporting roles like project management and sales, reinforcing the scale of opportunity that net zero carbon presents to the economy, but also the opportunity that employers have to position roles as green jobs.

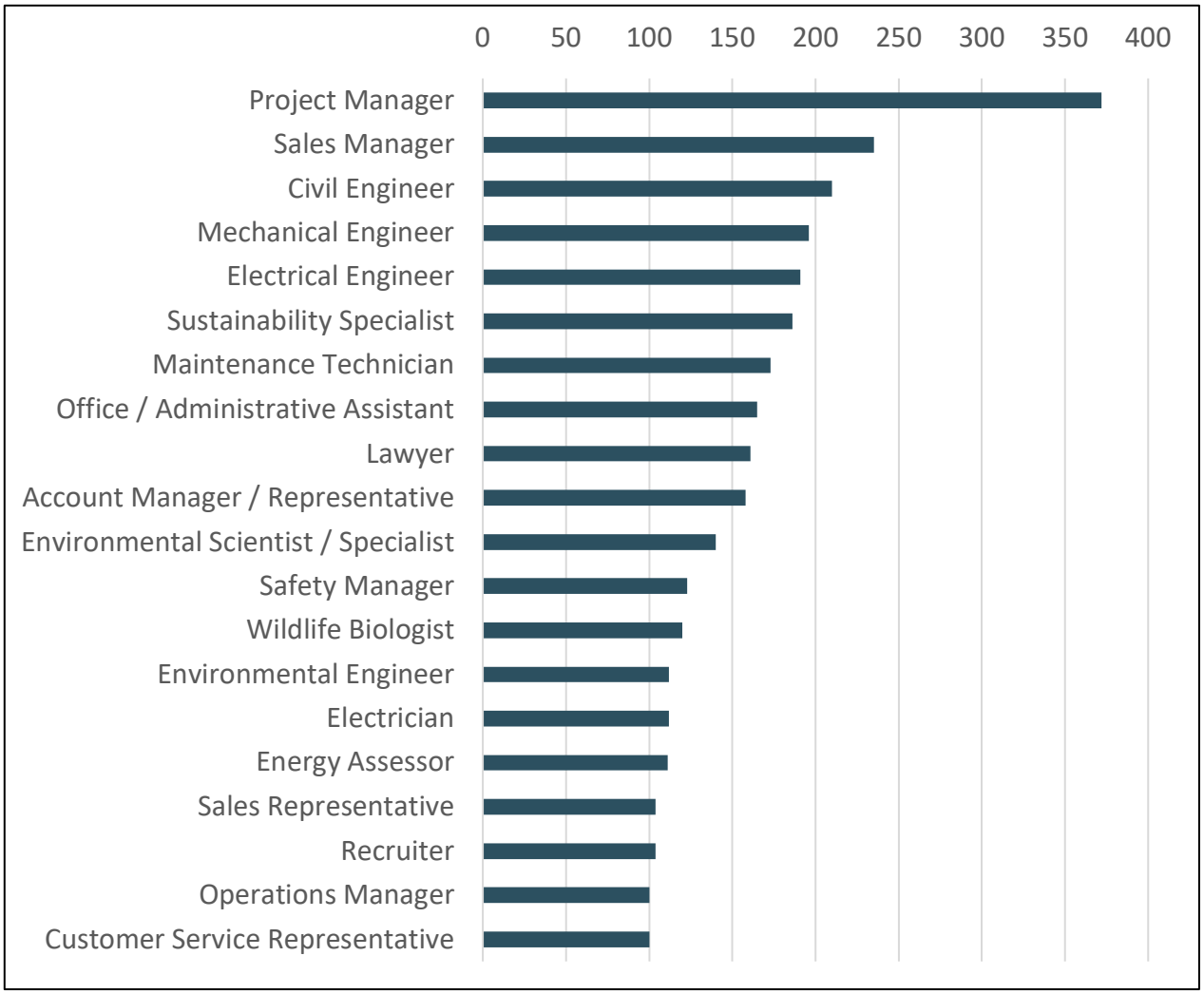

Figure 3. Types of green jobs advertised in Greater Manchester in 2021.

3.10. Supporting the vacancy data, employer intelligence indicates a need for formalised project management and change teams for carbon reduction. Decarbonisation is one of the biggest shifts the wider economy will ever undertake – ensuring that the rollout of green technology, processes, and business practices goes smoothly is critical. Data analytics and other digital skills are also needed in several sub-sectors as energy, heating, and transport systems become increasingly "smart". Both project management and wider digital skills are also in demand from other sectors, so increasing overall supply of these skills is important.

3.11. Across all five areas, employers reported a need for technical skills, which were usually specific to sub-sector but in some cases cut across multiple sectors. For example, the need for skilled electricians and electrical engineers is increasing as buildings and transport become increasingly electrified, and

the energy grid undergoes improvements. Across the challenge areas, there is a heavy tilt towards sectors where STEM (Science, Technology, Engineering, and Maths) careers are important. As is made clear in the Green Jobs Taskforce Report (ONS, 2021), much of the transition to net zero carbon will be fuelled by innovation – the scientific research into new technology, which will then be adopted by manufacturers and engineers. Just as science has developed our understanding of carbon emissions, there is hope that it will provide the solution to the effects of them. As a result, STEM skills are of the utmost importance to the transition.

3.12. With a wide range of potential future technology that is needed to close the innovation gap, the skills needs are even less clear. Developments in areas like Carbon Capture, Utilisation & Storage (CCUS), nuclear power (fission/fusion), hydrogen fuel, and electrification in sectors like aerospace will create a new set of skills requirements but are primarily regarded as long-term technologies that are at least several years away from marketability. Ensuring a skilled workforce to work in these areas should be a top priority for the wider skills system. This may take the form of ensuring agile and adaptable workers who can pick up new technologies easily.

Skills supply

4.1. From 2023, new Local Skills Improvement Plans (LSIPs) will set out, from an employer perspective, the key priorities and changes needed in an area to make post-16 technical education/training more responsive and closely aligned to local labour market needs. The statutory guidance includes an explicit requirement to describe how skills, capabilities and expertise required in relation to jobs that directly contribute or indirectly support net zero carbon targets, adaptation to climate change, or meet other environmental goals have been considered. Many training providers are starting to shift their existing (non-green) provision to support skills for net zero. This includes curriculum adaptions, such as construction provision adapting to include retrofit and renewable energy installation elements. In addition to this, there is a growing list of dedicated green courses, serving both the specific sectors listed above, and the wider economy.

4.2. **Schools & FE** - With STEM and Construction pathways critical to many roles in the Green Economy, it's important to review Greater Manchester's credentials in these areas and understanding the skills supply chain starting with schools and ending in labour market. Across the nine General Further Education colleges in Greater Manchester, 2019-20 saw 23,686 students start a qualification on Engineering, Digital, or Science/Maths pathways. Of these, just under 6,000 were Level 3 or above. The same year saw 5,643 starts on Construction related pathways, of which 1,331 were level 3 or above. It's important that individuals studying STEM/Construction pathways are supported to go on to valuable apprenticeships and entry level positions. Focus is on three areas of learning – apprenticeships, non-workplace based vocational learning, and university provision.

4.3. **Apprenticeships** - There are several apprenticeship standards in development which will directly support net zero carbon. Many construction apprenticeships will be relevant to retrofitting and infrastructure upgrades. Upcoming and recently approved standards include the Domestic Electrician Level 3, Low Carbon Heating Technician Level 3, Landscaping Technical Manager Level 5, and Professional Arboculturist Level 6. These standards will

contain content highly relevant to roles within net zero sectors – ensuring that employers and providers engage with these is critical to their success. One apprenticeship which will have a big impact for employers and retrofit in particular – the Low Carbon Heating Technician Level 3 – is not yet ready: it should start to be delivered in 12-18 months. Employers reported that currently, they have to train new starters on plumbing or other trade apprenticeships. However, these apprenticeship pathways aren't entirely appropriate – an installer of low carbon heating systems needs a wider range of skills than any one particular trade.

4.4. **Higher Education** - Universities in the region already deliver various degree and postgraduate courses that are relevant for net zero carbon jobs. These include the BSc Environmental Management (University of Manchester/University of Salford), BSc Environmental Science (Manchester Metropolitan University), MSc Electric Vehicle Technology (University of Bolton), and BSc Environmental Geography (University of Salford). While the student volumes on most of these courses are relatively small, there are many students on degree programmes that indirectly support net zero, providing net zero is embedded within the curriculum material. These include the likes of Electrical Engineering, Construction Project Management, Civil Engineering, and Architecture.

4.5. There are challenges with improving the skills supply for green occupations. with the skills system struggling to keep up. There are a few instances where appropriate qualifications are still in development, so cannot yet be delivered by providers. Another barrier is cost – with so many net zero carbon occupations also being technical pathways, real-world equipment on which to train is a requirement for delivering high quality training. In some cases, this equipment can be prohibitively expensive, especially for schools and colleges.

4.6. Greater Manchester is in a reasonable position to maximise the skills development and employment opportunities. The ambitions of the city region to reach carbon neutrality are well-known, and the skills system is already beginning to respond. With a focus around low carbon buildings and transport, the workforce will begin to retrain as these opportunities develop. Once

national skills infrastructure catches up, in the form of course accreditation, apprenticeship approvals, and funding flexibility, the system will be in a better position to scale up skills in the workforce at the pace required.

Investment

5.1. Delivering net zero carbon requires investment across the economy, but especially the energy system: from physical infrastructure to smart technology across industry, business, public sector, and domestic assets. In 2021, Energy Systems Catapult (ESC) started work to deliver Local Area Energy Plans (LAEP) for each of the 10 Districts across Greater Manchester, and an overall Insights Report for the whole city-region (ESC, 2022). These LAEPs explore the actions and investments needed between now and 2038 in different areas of Greater Manchester to reduce emissions.

5.2 Progressing the outcomes detailed in the LAEPs will help to realise the potential of a local energy market for Greater Manchester. The LAEPs considered wider non-technical factors which influence the deliverability, pace and scale of change required for decarbonisation. Short-term action is crucial to lay foundations for longer-term changes.

5.3 In 2022, EY undertook further analysis with the LAEPs to help the GMCA to identify the level of investable opportunity required to deliver on the 2038 carbon neutrality targets[15]. Together with the LAEP data, this analysis identified that £64bn of investment is required to reach 2038 carbon neutrality (once energy costs are removed), with £43bn required for heating and insulation of buildings, and the remaining £21bn needed for energy generation, distribution, and storage. Not all of this is new investment: approximately 70% represents business as usual activity within the energy system (i.e maintenance) that will still be required. The LAEPs have outlined what is a 'realistic' level of investment in the energy system to reach carbon-neutrality. Whilst urgent action is required by all areas of the economy to reduce emissions, the scale of workforce and innovation that is needed, is not yet in place. This means that in the immediate future (to 2025), the LAEPs identified £6bn of the total £64bn is required, and only 10% of this is within

[15] EY undertook this work on behalf of GMCA to start to explore the outputs of the LAEP in more detail. This initial insight work has not been published but is used by the GMCA in their work.

public sector control. A further £4.6bn of this is the responsibility of individual households and businesses (including energy costs). The remaining cost will need to be met by novel commercial models. The investment levels reported as part of the LAEPs don't include the affect of policies, subsidies and incentives (e.g. Home Upgrade Grants) given the dependence of these on specific Government activity that may not be in place for the duration of the LAEPs.

5.5 These investments will need to be resourced in a fair and equitable way. This will be increasingly important given the wider context at the time of writing this report around cost of living, and energy prices. Those in, or increasingly at risk of fuel poverty must not be disadvantaged, whilst also recognising that improving the energy efficiency of properties and moving towards low carbon heating technologies is a win-win in terms of reducing carbon emissions whilst reducing inequalities. However, for consumers to shift behaviours and attitudes to more low carbon options, the market needs to make it accessible (i.e. cost-friendly) and easy to do so. The business case for domestic retrofit is increasingly gaining traction as energy prices continue to rise, although continued pressure on household budgets may limit the ability of residents to invest in retrofit.

5.6 The LAEPs identified that in the immediate short-term (to 2025), it will be critical to take-forward no-/low-regret options to maintain progress towards the carbon target of a carbon neutral Greater Manchester by 2038. The relative low levels of investment needed in the short-term provide the opportunity for trial projects to be initiated and potentially scaled up after this period. Crucially, the inherent time-delays in design, development and delivery of innovative technologies requires strong and challenging decisions to be taken now, for investment to be directed where needed.

5.7 Drawing on analysis that included Greater Manchester, a 2022 UKRI report reinforced that a place-based approach to local climate action enables city-regions to adopt the most socially cost-effective combination of low carbon measures (compared to a place-agnostic approach universally applied across the country) (UKRI, 2022). The report found that a place-based approach

requires significantly less investment and provides almost double the energy savings. Through recognising the specific challenges and opportunities afforded to Greater Manchester, low carbon ambitions can be better realised through local activities.

5.8 The report also identified one of the main blockers currently preventing benefits of low carbon measures being realised is the supply chain skill deficit (along with governance, portfolio design and management, and funding and finance). The report proposes an enhanced local net zero carbon delivery framework is urgently needed to decarbonise cities and towns. An underlying principle of this framework is that a whole-system approach is required. Specifically, for the Local Government, the following recommendations are made from the report:

Place-based approach recommendations for Local Government

1) Assume appropriate accountability for net zero portfolios for buildings and transport, and adopt a coordination role
2) Identify and appraise the most appropriate low carbon measures for each place and interventions that will support their adoption
3) Lead management with local system actors including businesses and communities to prioritise opportunities and capture projects to a consistent standard in Local Area Energy Plans
4) Build core internal technical and delivery capacity and bring in external specialist skills from Local Net Zero Hubs or the private sector, as required.
5) Assess skills needs for local net zero delivery and audit capacity to inform the national skills deliver plan.

Policy implications & challenges

6.1 Greater Manchester aims to be carbon neutral by 2038; only 16 years away. To deliver this, investment is needed across the region's physical capital (infrastructure and resilient places), human capital (skills), and productivity. Therefore, the challenge is to not just incorporate a low carbon agenda, but to actively direct all economic activity and wider society towards net zero.

6.2 The biggest challenge is that action must be taken now in order to deliver the required level of change. This must be whole-system, and economy-wide: from consumer behaviours and business models, to how we heat our homes and travel around the region. Delivering the level of change required to transition the economy to net zero carbon requires changes to skills and supply chains as well as technological innovation, and behaviour change, all of which requires political will and investment. It is not just about strengthening the specific sectors that provide the capacity to deliver net zero but supporting all sectors to decarbonise.

6.3 The GM LIS set out how businesses will need support to accelerate decarbonisation and increase energy and material efficiency, through all aspects of design, production, and service. Greater Manchester's strengths in advanced materials and manufacturing, digital technology, and our strong research assets, will all play a part in supporting this decarbonisation.

6.4 Questions remain as to how the Greater Manchester economy can support this urgent action and continuously scale-up activities. A carbon neutral city region by 2038 is the ultimate target, but the next two to four years is where the opportunity to keep within the carbon budget may be won or lost. Ensuring the skills and labour requirements to do this are met, with haste will be critical.

6.5 To deliver net zero carbon, there are opportunities to grow the jobs and industries at the forefront of clean and green growth in Greater Manchester, as set out in the LIS in 2019. However, in doing so, trade-offs between 'green', 'just' and 'fair' priorities must be made explicit, and where possible, co-benefits realised. Lowering energy bills while reducing carbon emissions is a good example where priorities align well. Skills development and high-

paying infrastructure jobs are a way that the transition to net zero can benefit residents. Particularly, ensuring that workers in “brown” jobs are considered during the transition is important.

6.6. Net zero carbon is not just a Greater Manchester challenge, but an opportunity for the city region to lead UK and international delivery. Some activities that will enable a carbon neutral Greater Manchester will require UK Government to lead, and therefore will be planned as part of a 2050 net-zero carbon strategy. That said, several activities that support net-zero are within Greater Manchester’s influence. The refreshed Local Industrial Strategy is not a silver bullet for net zero, but it does provide opportunity to support a low carbon transition. It can provide a framework and enabling environment in which businesses can learn from each other, innovation can transfer through the market, and consumer attitudes and behaviours shift towards low carbon.

References

BEIS (2022) *UK local authority and regional greenhouse gas emissions national statistics, 2005 to 2020*, National statistics, Available online: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics-2005-to-2020

BEIS (2021a) *UK Net Zero Strategy: Build Back Greener*, HMGovernment

BEIS (2021b) *Future Support for Low Carbon Heat: Boiler Upgrade Scheme. Government response to Clean Heat Grant proposals within 'Future support for low carbon heat' consultation*, London.

Broome, M., Cellini, S., Henehan, K., McCurdy, C., Riom, C., Valero, A., & Ventura, G. (2022) *Net zero jobs: The impact of the transition to net zero on the UK labour market*, The Resolution Foundation, June 2022

Cornwall Insights (2022) *Price cap forecasts for January rise to over £4,200 as wholesale prices surge again and Ofgem revises cap methodology*. Available online: https://www.cornwall-insight.com/price-cap-forecasts-for-january-rise-to-over-4200-as-wholesale-prices-surge-again-and-ofgem-revises-cap-methodology/

Energy Systems Catapult/GMCA (2022) *Greater Manchester Local Area Energy Planning: Overview and Insight*, Prepared by Energy Systems Catapult for Greater Manchester Combined Authority.

GMCA (2022) *Industry Labour Market and Skills Intelligence Report: Green Economy*, GMCA

GMCA (2022a) *retrofitGM: Accelerating the Renovation of Greater Manchester's Buildings*, Greater Manchester

GMCA (2022) – Evidence Update, GM Independent Prosperity Review

GMCA (2021) The Greater Manchester Strategy 2021-2031: good lives for all

GMCA (2021a) The IGNITION Project. Available at https://www.greatermanchester-ca.gov.uk/what-we-do/environment/natural-environment/ignition/

GMCA (2020). GM Independent Prosperity Review: One Year On. Available at gmipr_one-year-on.pdf (greatermanchester-ca.gov.uk)

GMCA (2019a). Local Industrial Strategy. Available at gm-local-industrial-strategy-web.pdf (greatermanchester-ca.gov.uk)

GMCA (2019b). Reviewers' Report, GM Independent Prosperity Review. Available at gmis_reviewersreport_final_digital.pdf (greatermanchester-ca.gov.uk)

GMCA (2019c) *Five-Year Environment Plan for Greater Manchester* 2019-2024

GMCA (2016) *Our People Our Place: Greater Manchester Strategy* 2017-2020

GMCA (2009) Manchester Independent Economic Review

Kuriakose, J., Anderson, K., Broderick, J., & Mclachlan, C. (2018). *Quantifying the implications of the Paris Agreement for Greater Manchester*. University of Manchester.

Office for Budget Responsibility (OBR) (2021), *Fiscal risks report*, July 2021

ONS (2021), *The challenges of defining a "green job"*, Available at: https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/thechallengesofdefiningagreenjob

PwC (2022) The Energy Transition and Jobs. Can people transition to new green jobs?,

Transport for Greater Manchester (TfGM) (2021) *The Bee Network*. Available at https://beeactive.tfgm.com/bee-network-vision/

UKRI (2022) *Accelerating Net Zero Delivery: Unlocking the benefits of climate action in UK city-regions*, Innovate UK