



# TfGM Energy & Carbon Strategy 2016 -2021

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## **Executive Summary**

The UK Government has committed to take action against climate change and has ratified the international Paris agreement which commits the UK to keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels; and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

To progress this the government has introduced the Climate Change Act with a target to cut carbon emissions by at least 80% by 2050, with a minimum reduction of 26% by 2020 across the UK (from 1990).

TfGM working alongside the Greater Manchester Combined Authority (GMCA) aims to support these targets and to demonstrate early success on the way. This ambition is supported by the Greater Manchester Combined Authority who introduced the GM Climate Change Strategy in 2011 that set out ambitious targets to reduce regional CO<sub>2</sub> emissions by 48% by 2020 (from a 1990 baseline). The current GM Climate Change implementation plan was updated in 2016 where it states that TfGM will take the leading role in delivering solutions to lower transport emissions.

Carbon management is an increasingly important issue for all organisations. Taking sustainability and carbon emissions seriously is an integral part of a high quality transport network. TfGM's longer term carbon responsibilities must be to reduce emissions and operating costs associated with both the transport networks it has influence over and the infrastructure assets it operates directly.

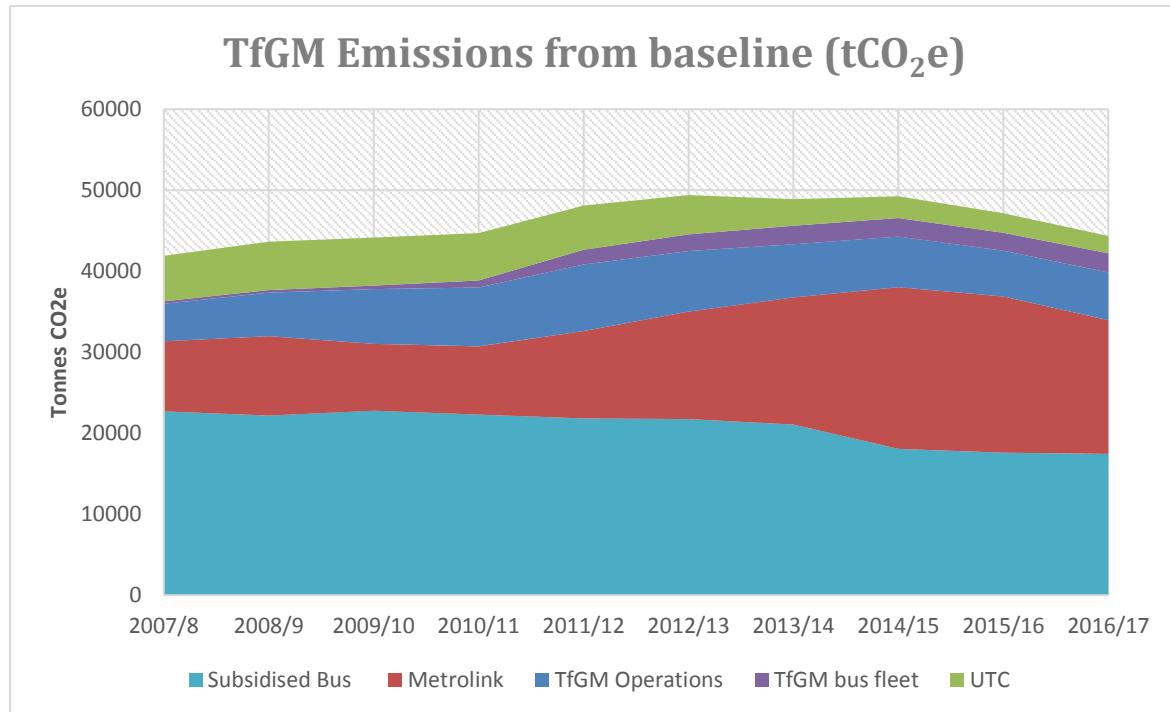
TfGM has a carbon footprint of 41 thousand tonnes CO<sub>2</sub>e per year. Analysis shows that approx. 90% of the TfGM emissions reside in three specific areas:

- Subsidised Bus fuel 42%
- Metrolink Traction electricity 27%
- Property Services (Interchanges and Offices), Metrolink sites & external lighting electricity at 20%.

Despite an increase in efficiency there has been significant expansion to TfGM operations since the 2007 baseline, which has resulted in a 2% increase. As one of the objectives of the public transport system is to help others reduce their emissions,



achieving a target in line with the Climate Change Act and GM's ambitions is unrealistic and would restrict growth.

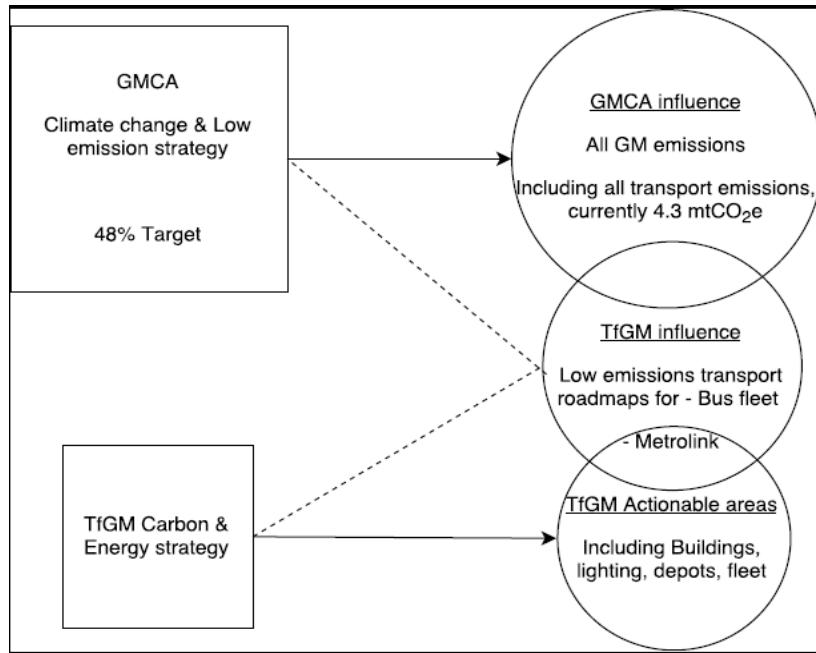


TfGM's ambition is therefore to reduce its CO<sub>2</sub> emissions from those areas over which it has direct financial and operational control including property sites, lighting and all TfGM owned fleet vehicles and areas over which it has influence such as Metrolink lighting and sites. This strategy aims to reduce emissions from these operations by 15.5% by 2021, this equates to approximately 1,596 tonnes CO<sub>2</sub>e.

This will be achieved through major capital investment in energy efficiency projects and renewable energy schemes.

When Metrolink traction energy and subsidised bus fuel are returned into scope this equates to a 3.8% reduction of the entire footprint.

Hence, there is a new requirement for TfGM to develop a separate Transport Emissions roadmap (similar to Transport for London) which specifically targets Metrolink traction, Bus fuel emissions and other similar transport assets.



The emissions from the Subsidised Bus miles relate to 40% of the total TfGM footprint are produced by third party operators, where the operators pay for the fuel, hence the majority of bus fuel emissions are recorded within the individual bus fleets own carbon footprint. TfGM will therefore collaboratively develop a new Transport Emissions Roadmap that provides a long term strategy for the introduction of low and zero emission tailpipe vehicles.

Metrolink Traction Electricity is responsible for 27% of both the TfGM CO<sub>2</sub> emissions and the associated TfGM operational energy costs. Therefore Metrolink will be given a specific focus in developing an implementation plan to cost effectively mitigate current and future energy and carbon impacts.

It should be noted that increased Metrolink and bus patronage are key priorities in the GM climate change implementation plans, so while emissions are increasing as the network grows, they are conversely decreasing regional emissions through modal shift. This is largely an assumption at present and requires analysis of passenger behaviour to quantify emissions savings.

These roadmaps will result in further reductions to the overall TfGM footprint but as it stands these emissions are unquantifiable until roadmaps are in place.



## **Energy and Carbon Management**

Scalable carbon reduction solutions have been identified to reduce energy emissions associated with the operation the TfGM Facilities Management (FM) sites, Metrolink Depots and Metrolink tram stops. These assets only account for 20% of the total TfGM emissions.

A focus of this Carbon and Energy Strategy is to reduce emissions relating to the design and operation of TfGM sites and also all external lighting systems across all TfGM operations. Implementation of these measures will reduce associated energy costs by the same amount during that period.

The longer term forecast is that the net cost of electricity is set to increase. It is entirely possible that the TfGM energy costs could increase by at least 50% by 2021. This cost increase could equate to additional £2.68 million energy costs for identified areas of the TfGM business. TfGM will therefore seek to implement projects that aggressively target CO<sub>2</sub> emissions to allow TfGM to negate risk and reduce its exposure to future energy price increases.

## **Conclusion**

TfGM will ensure that responsibility and accountability for carbon reduction are clear and that action to reduce carbon becomes integral to all design work programmes and staff activity. TfGM's aim is that consideration of carbon implications becomes a business as usual activity, embedded in each Department's delivery plans and activities

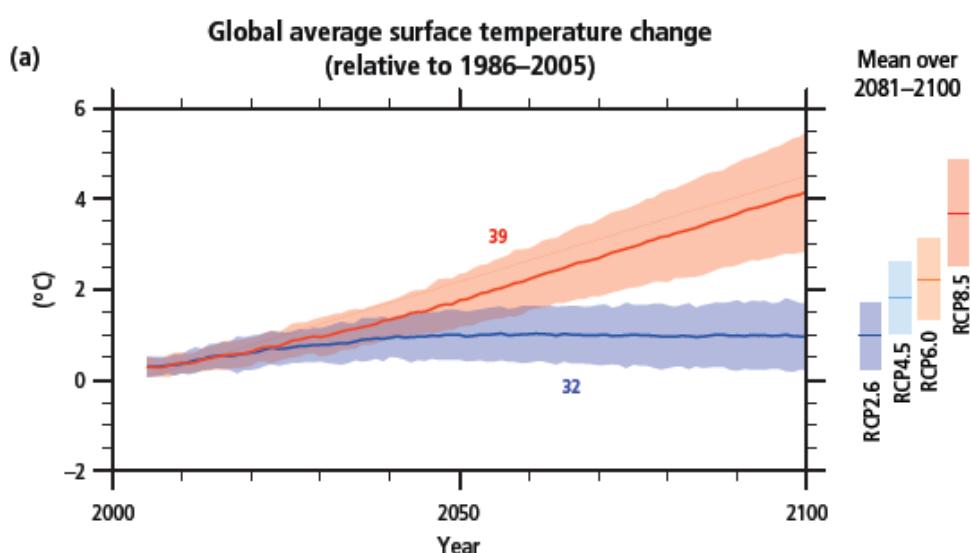
This strategy and accompanying implementation plan will guide TfGM Departments to align their actions with TfGM's goal to become a low carbon organisation.

The foremost priority of TfGM is to reduce both energy costs and the associated emissions whilst supporting the ongoing business continuity measures. To this end, there needs to be major capital investment in energy efficiency projects and renewable energy schemes.



## Why do we need to act now?

Current scientific consensus is that rapid change is being caused by the release of significant anthropogenic emissions since industrialisation. Evidence shows that there has been an 0.8°C rise in surface temperatures since pre-industrial levels and that this likely to reach 2°C by 2050 (IPCC, 5th report) these changes are inevitable due to the level of gases already in the atmosphere.



This planetary warming will cause changes in sea levels and local weather patterns, such as increased heavy rainfall and flooding. The biggest risks to Greater Manchester from climate change come from energy supply security and cost, future increases in extreme weather events, and economic competitiveness as resource costs are increasingly taxed.

Unless we all take effective action now, millions of people around the world will suffer hunger, water shortages and coastal flooding as the climate changes. As one of the Greater Manchester's largest organisations, TfGM has an imperative to act in order to make a real difference and to set a leading example.

There is also a strong financial incentive to address climate change. The Stern Review<sup>1</sup> concluded that the benefits of strong, early and coordinated action against climate change far outweigh the economic costs of doing nothing. It is estimated that

<sup>1</sup> Stern Review on the Economics of Climate Change, 2006, Cambridge: HM Treasury: Cambridge University Press

the cost of not taking action could be equivalent to losing between 5% and 20% of annual global GDP, whereas the cost of taking action can be limited to around 1% of annual global GDP. Failing to take the right action now and over the coming decades risks major disruption to economic and social activity that would be very difficult and costly to reverse.

### **Climate adaptation**

In addition to mitigation of anthropogenic sources of carbon, TfGM needs to consider the implications of a changing climate and begin to build resilience. In Greater Manchester, projections show that average surface temperatures and precipitation levels will rise along with the number of extreme weather events such as flooding and heat waves. The complexity of the current transport system has an amplifying effect on these impacts and therefore it is critical to prepare for future risks.

TfGM will continue to strategically plan for climatic change by projecting and considering possible medium to long term change. Measures will continue to be embedded in designs for new interchanges and infrastructure projects and innovative hard and soft adaptation approaches will be considered.

### **Air Quality**

Air quality and climate change are interlinked concepts, for example, climatic effects such as increasing summer temperatures will affect the frequency and severity of high level occurrences of air pollutants.

While the primary focus of this strategy is Carbon reduction, linked strategies including the GM Climate Change Strategy, the Low Emissions Strategy and the Air Quality Action plan have brought together these concepts to identify cost effective solutions and prevent competing agendas.

As a lead organisation on air pollution reduction, TfGM will consider its operational impact on both forms of emissions, in particular fleet mileage, business travel and staff commuting

### **Legislation**

There are several sets of regulations designed to reduce carbon emissions. TfGM complies with these. GM has demonstrated clear commitment alongside global cities by becoming a signatory to three International commitments; The Integrated Covenant of Mayors, the Compact of Mayors, and Under 2 MOU. These commitments have emissions targets that are either in line with or greater than national targets.



They also specify methodologies, comprehensive action planning, monitoring and reporting.

The European Union has been committed to tackling climate change both internally and internationally and has placed it high on the EU agenda, as reflected in European climate change policy. Examples of European legislation aimed at reducing emissions includes the Energy Performance of Buildings Directive (EPBD) and the EU Emissions Trading Scheme.

The Government passed the Climate Change Act in 2008 which makes it a legal requirement to achieve at least a 34% reduction of UK carbon emissions (compared to 1990 levels) by 2020 and a reduction of at least 80% by 2050. In 2009, the Government published the UK Low Carbon Transition Plan setting out a route map for the UK to meet these targets. This has been followed by successive 4 years “carbon budgets” reflecting the scientific reality that if cuts are delayed, greater cuts are needed further down the line.

### **Energy Costs**

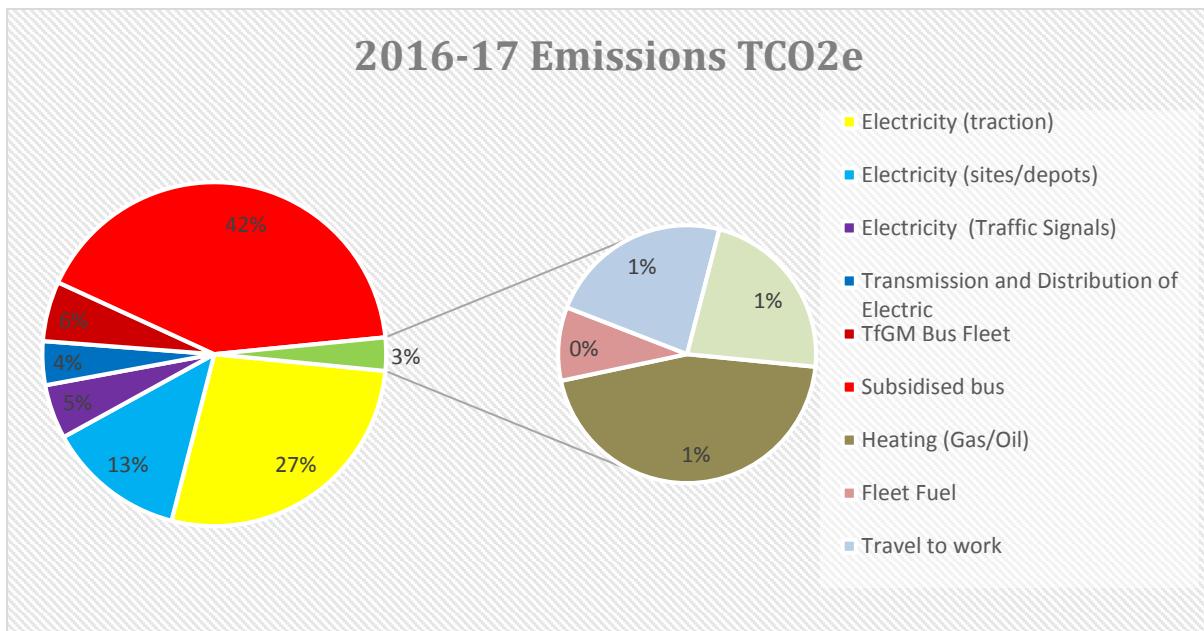
There are many unpredictable factors affecting energy unit costs that will in turn affect TfGM’s energy costs in the long term. Future scenarios of energy costs in general predict rising costs, for example BEIS (Department for Business, Energy and Industrial Strategy) projections foresee an electricity price increase of between 28% and 50% above inflation between 2017-2021 while gas unit costs are projected to increase at 40%.

The key conclusion that results from this analysis is that TfGM’s energy costs will rise significantly unless TFGM invests now in energy and carbon savings. Even though TfGM is taking action to reduce emissions, energy and carbon costs would still rise in the longer term without further action. By adopting the ambitious energy and carbon reduction proposals outlined in this strategy, TfGM can deliver significant potential cost savings.



### The Carbon footprint of Transport for Greater Manchester

Overall Carbon emissions in 2016/17 were 41,991 tCO<sub>2</sub>e. This compares to a 2007 baseline of 41,607 tCO<sub>2</sub>e, a marginal increase of 2%.



These emission sources are calculated using the financial method under WRI's GHG protocol. This means TfGM defines its boundaries as those operations over which it has financial control. This approach is considered best practice and is employed to create a complete and high quality representation of emissions sources. This methodology defines accountability; assigning ownership of emissions that an organisation can influence and reduce.

When emissions sources are analysed we can clearly see that a significant proportion can be attributed to subsidised bus mileage (42%) and Metrolink traction energy (27%). As aforementioned a transport road map should be produced to determine a long term strategy for the introduction of low emission buses to phase out diesel vehicles currently operating in the commercial fleet.

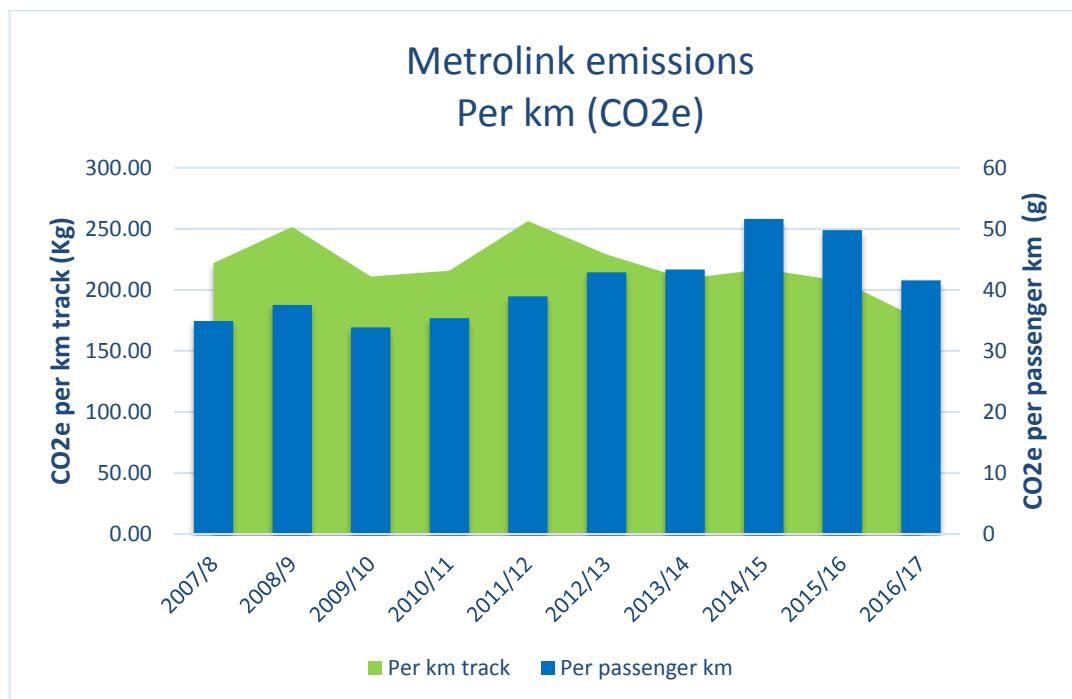
This strategy therefore aims to target actionable areas of TfGM's carbon output, targeting an absolute reduction of 3.8% (1,596 tonnes) by 2020. To put this in context emissions associated with TfGM and Metrolink sites, depots, lighting and stops equates to 19.5% (8,205 tonnes) and therefore the target would reduce emissions from actionable areas of operations by 15.5%.



## Metrolink

Metrolink emissions were 16,493 tCO<sub>2</sub>e in 2016/17 which equates to an increase of 90% on 2007/8 levels. If carbon outputs are measured by intensity per km of track operated then emissions have in fact reduced from around 220 tCO<sub>2</sub>e per km to 175 tonnes per km.

Under this methodology travelling by Metrolink continues to be the best option for low carbon travel per passenger.



## TfGM Bus emissions

Subsidised Bus emissions were 17,452 tCO<sub>2</sub>e in 2016/17 this is a real term fall of 23% from 2007. Subsidised emissions do not represent the overall picture of bus emissions; subsidised mileage represents around 15 - 20% of all bus mileage in GM. The amount of subsidised mileage is currently falling each year, which accounts for the fall in associated emissions; this does not indicate that overall bus emissions are falling. However, with fleet renewal, the introduction of improved engine efficiency, Hybrids and alternative fuels then bus emissions should fall despite growth in mileage.

TfGM also operates 145 buses for the Metro shuttle and Yellow school bus services. This fleet has grown from the 34 buses operated in 2007. In 2016/17 these buses produced 2,368 tCO<sub>2</sub>e, an increase of 24% on 2007.



This fleet utilises diesel-electric hybrids, retrofitted EURO VI diesels and also operates three fully electric buses. An emissions roadmap is required to scope out the gradual introduction of zero emission tailpipe vehicles for both commercial and TfGM fleets.

## What do we need to do?

### 1. Energy and Carbon Management

TfGM operations including Metrolink and Facilities Management estates consumed over £5.5 million worth of energy in 2016-17 which is responsible for over 18,900 tCO<sub>2</sub> emissions. Energy costs are projected to rise with increasing electricity usage across the business. For these assets, it is entirely possible that net electricity costs could increase by at least 50% by 2021, which equates to an additional £ 2.58 million a year in additional revenue costs for TFGM.

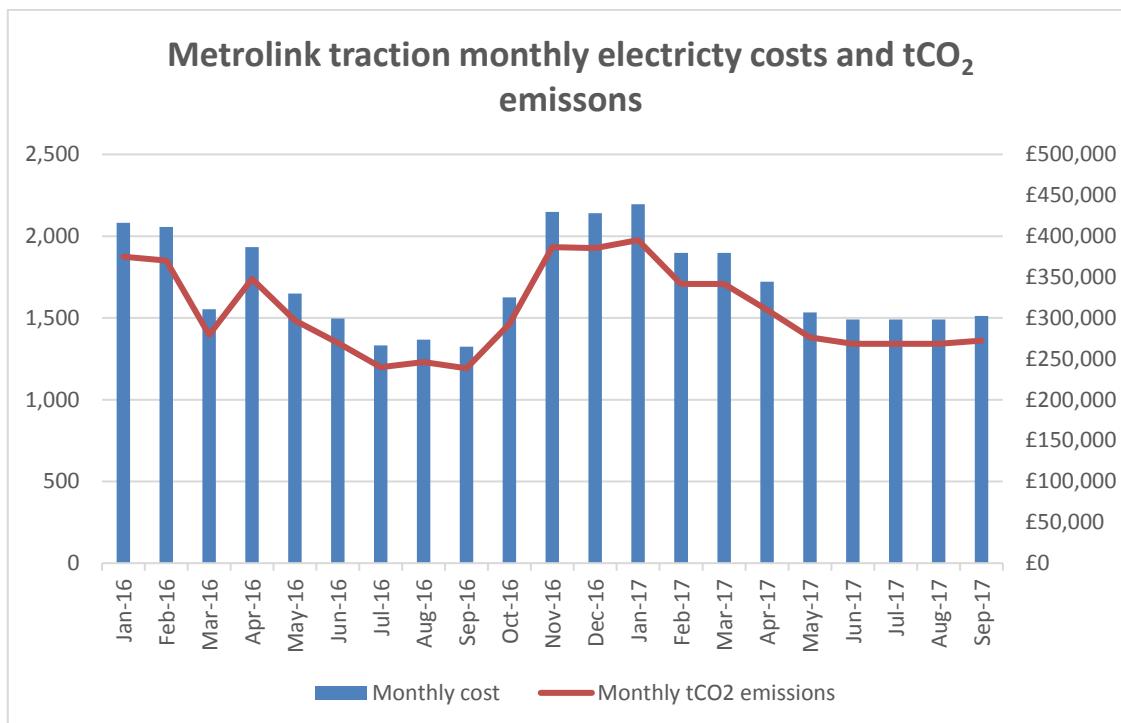
The table below show the effect on main TfGM Utility bills in 2020, if the unit energy costs increased by 50%.

Energy asset	Cost 2016-17	Sensitivity analysis -50% increase in costs by 2021	Net increase in cost
Metrolink traction electricity	£4,579,149	£6,868,724	£2,289,575
Property services electricity	£548,633	£822,950	£274,317
Property services gas	£39,251	£58,877	£19,626
Totals	£5,167,033	£7,750,550	£2,583,517

The cost of the Metrolink electricity is nearly ten times the value of the facilities management electricity. The majority of Metrolink emissions are indirect and result from traction electricity.



The graph below shows the monthly Metrolink traction electricity cost and CO<sub>2</sub> emissions for 2016-17. An implementation plan for Metrolink energy and carbon reductions has not yet been established, however a potentially targeted reduction of 30% within Metrolink would save 2.2 million pounds based on the anticipation of 50% increase in costs in 2021



A key risk of not targeting the Metrolink traction electricity cost and emissions is that any cost increase will either need to be passed onto the public in terms of increased ticket prices or be absorbed by TfGM.

For TfGM to achieve its strategic carbon reduction aims, a programme of retrofit PV and solar electricity storage need to be proposed for the suitable existing and new interchange / bus station sites, where the battery based electricity storage can then be used as an emergency electricity supply to operate essential bus interchange stations.



Using solar and store battery technology systems within Property Service could reduce emissions by 70% and also save over six hundred thousand pounds per year based on the anticipation of 50% increase in costs in 2021.

In terms of identifying investment grade projects for specific areas sensitivity analysis has been carried out to determine the areas of the business that would benefit the most in terms of reduced CO<sub>2</sub> emissions and associated energy costs. The details of this can be found in the Environment and Carbon Implementation Plan.

It is strongly recommended that a dedicated resource such as a Energy Projects Manager be recruited to help deliver and facilities manage the below new energy reduction systems.

### **Key Proposed Energy reduction projects**

#### Renewable Energy and Battery Storage

Fundamental to the success of this Energy and Carbon Reduction Strategy is that building designers need to maximise the opportunities for renewables such a solar PV electricity generation and potentially battery storage. This same approach should be taken across the existing TfGM Estate portfolio, which is to identify renewable energy opportunities for both new and existing buildings.

The current Building Control target for a PV installation is 15% of the yearly building usage. External roof space that forms part of any existing or new bus station or interchange should be assessed to determine the potential investment case for installing a large scale renewable project such as photovoltaics which are then capable of generating at least 50% of the yearly site electricity usage.

To operate the bus station / interchange lighting systems at night, then these buildings will need to accommodate a local battery store, the PV system will be used to recharge a local battery system. The system would need to be designed to provide the electricity required to power at least 40% of the site total electricity demand to include operating the entire external and concourse lighting circuits during the night-time period.



### Remote monitoring of upgrading building controls across the existing Estate

In addition, there are many buildings (including 2 Piccadilly Place) which would require replacement of their heating, cooling and BMS control systems to allow these buildings these building to be more energy efficient and hence produce less emissions.

### Retrofit LED lighting for all external lighting applications

A key parameter in reducing carbon emissions is to reduce the demand for energy. For example, the night-time electricity relating to the transport interchanges and the Metrolink stops are a significant part of the total (i.e. non-locomotive) carbon emissions.

A Metrolink LED replacement lighting feasibility study identified a potential for reducing 70% the CO<sub>2</sub> emission and operating costs associated with the night time use of lighting systems on the Metrolink Phase 1 tram platforms. The estimated emissions reduction equates to 450 tCO<sub>2</sub>, which is a circa 1% reduction in the total TfGM emissions.

### Solar and store technology

An example of the type of transformative carbon reduction measure required is the installation of 'Solar PV electricity generating systems that are to be combined with a local battery store', which are compelling business proposition. The payback on these types of renewable (retrofit and new build) systems are in the region of 5-7 years where the typical investment per site ranges between 70-180K, depending on the size of the building etc. This type of 'Solar and Store' system provides an automatic back up for the supply of electricity. It can also reduce electricity cost by 70% a year

This type of project provides a significant operational benefit in term of improved TfGM business continuity. The installation of 'Solar and Store' system means that in the case on an emergency, the site could still operate by running essential bus station services from its own local battery store. In the case of the new Bolton Interchange, a proposed new 'Solar and Store' Pilot system removes the significant



costs of installing both new high voltage electrical equipment interface and the requirement to hire temporary electricity generators.

The following prioritised list of measures focuses on the energy usage at Bus Interchange sites / Metrolink depots, and the Metrolink traction electricity.

Recommendations	Estimated Annual savings			Estimated cost (£)	Payback period (years)
	(£)	tCO2	KWh		
The retrofit installation of large-scale solar Photovoltaic (PV) electricity generation systems and local battery stores to the existing operational estate.	£192,032	659	1,600,267	£1,300,000	7
To replace and update all the existing external lighting systems at the Phase 1 Metrolink tram stops	£100,000	343	833,333	£300,000	3
To upgrade existing building controls to incorporate Building Energy Management Systems (BEMS) across the TfGM Property Services estate.	£54,863	188	457,194	£200,000	4
The inclusion at the PMS new project inception design stage of large-scale solar Photovoltaic (PV) electricity generation systems and local battery store to a new Bus Station / Interchange.	£15,000	52	125,000	£150,000	6
Replacement to the 'fan coil' heating and cooling system at 2 Piccadilly Place	£35,000	120	291,667	£250,000	7
To replace of the gas fired warehouse-heating control systems at the two Metrolink depots.	£14,000	48	116,667	£90,000	6
LED lighting replacement programme for external lighting at TfGM operational sites	£54,000	185	450,000	£150,000	3
Totals	£464,895	1,596	3,874,128	£2,440,000	5



### **Metrolink Energy reduction**

In addition to the aforementioned projects a Metrolink Energy & Carbon Management plan needs to be developed by the operator (KAM) with the assistance of the Metrolink engineering team. To avoid the forecast electricity increases, it's recommended that plan identifies a suitable programme of works for implementation up to the period 2020/21.

The proposed Metrolink management plan will need to consider a range of measures, which may include the introduction of fleet low CO<sub>2</sub> emission traction engines, and also the potential use of renewable technology such as combined heat and Power (CHP) to off-set electricity usage at the electricity sub-station. This work should be done in association with other GMCA stakeholder to target the electrical power generation and the electrical distribution part of the network. There is currently no project roadmap within Metrolink to reduce either the stated emissions or to reduce operational energy costs.

### **2. Low carbon travel, transport and access**

TfGM recognises that its biggest impact is on the emissions from transport in the region. TfGM has a complex role to play in transport, as it directly controls some infrastructure and services, and can only influence some other areas. However, the organisation recognises that its role is to lead the drive towards low carbon transport in the region. TfGM has published its 2040 Transport Strategy and has prioritised actions in the GM Climate Change Implementation Plan which outlines how TfGM will drive forward a reduction in GM transport emissions. TfGM will prioritise low carbon transport modes, and seek to encourage behavioural change, increasing the share of walking and cycling trips. TfGM will also seek to bring external funding for low carbon transport improvements to Greater Manchester.

#### **How will we deliver?**

- The Metrolink operator, KAM, have an obligation to produce an energy & carbon management plan and, due to the fact that they take the energy consumption risk under the Agreement, have the incentive to reduce energy consumption.
- Metrolink will continue to monitor KAM's development of its energy management plan throughout the transition period, whilst working collaboratively with them to ensure TfGM's recommendations are considered and included where appropriate.

- further electricity efficiencies. Proposed lighting savings are detailed in the table in section 1.
- TfGM will investigate testing of electric buses and other low carbon fuels. In 2017 TfGM is working with Volvo to test a new electric bus and opportunity charging system. TfGM will apply for national funding for low emission buses and make a strong case to the government for air quality funding to transform the GM bus fleet.

## Staff Travel

TfGM need to be exemplar in leading the population-wide shift from sedentary travel to more active and low emission travel such as walking, cycling and public transport. TfGM has conducted travel surveys with staff to track progress towards this goal, the most recent survey in 2016 indicated a continued downward trend in single occupancy car use mileage (9%) and an uptick in public transport, particularly rail (42%) and tram (19%).

## How will we deliver?

- TfGM is committed to supporting flexible working opportunities. This enables some staff to alter work travel times to avoid peaks in congestion. TfGM will continue to explore dynamic working options that will reduce travel further.
- TfGM will continue to implement and develop its successful Travel Plan, the plan is monitored through a staff travel survey that provides insight into staff business travel and commuting. The plan includes a wide range of incentives to encourage TfGM staff to reduce their travel demand and choose more sustainable modes both for commuting, and for business mileage.
- Some TfGM staff currently use their own vehicles for work purposes. This “Grey Mileage” is generally split into casual and essential users. We will investigate opportunities to improve the carbon and financial efficiency of the fleet. One way to do this would be the use of low emissions car club vehicles for casual users and support for essential users to purchase ultra-low emissions vehicles (ULEVs).

## Fleet vehicles

TfGM has committed £17million to low carbon buses, after being awarded £5m funding from DFT. This resulted in the purchase of 66 low carbon buses, which have been operating as part of Metroshuttle services, Yellow school buses and general service fleets. Savings resulting from improved engines are estimated to be 5440 TCO<sub>2</sub>e. In recent observations across the wider GM fleet, 15% were Diesel-Electric Hybrids and 3% were running EURO VI diesel engines.

TfGM was also previously successful in a bid to the Clean bus fund, this provided £161k to retrofit the seven remaining yellow school buses to EURO VI standard.

## How will we deliver?

- TfGM aims to reduce emissions from its fleet of vehicles, by encouraging efficient driving and renewing the least efficient vehicles. All future leases will be required to be EURO VI and exceed government buying standards in terms of carbon performance. Drive cycles for ancillary vehicles used for maintenance will be analysed and where possible hybrid, electric or alternatively fuelled vehicles will replace conventionally fuelled vehicles. These will join our existing fleet of ULEVs that include two electric vans, a hybrid Toyota Prius and electric Nissan Leaf.
- TfGM will look to continue to increase the efficiency of its Metroshuttle and YSB fleet. As previously mentioned the fitting of selective catalytic reduction systems have led to air quality improvements. Carbon reductions will be achieved through continued optimisation including engine idle controls, software to improve throttle control, regenerative braking and on bus telematics to improve driver performance on electric and hybrid buses.

## 3. Designing the built environment

TfGM is responsible for investment in transport infrastructure in Greater Manchester, bringing economic benefits to the region. However, TfGM also recognises that projects including new interchanges and infrastructure can have a significant impact on GHG emissions both through construction activity and ongoing resource requirements.

There is a significant opportunity to enhance blue-green infrastructure and consequently biodiversity. Urban greenspace is particularly valuable in reducing the atmospheric concentration of CO<sub>2</sub> by sequestering (absorbing) it through trees and

other biomass. In addition trees can help filter particulates, intercept rainfall and provide shade and cooling, therefore reducing the demand for heating and air conditioning

Green spaces also provide aesthetically pleasing environments. Paths and cycle lanes through green space are usually very attractive and can support behavioural shifts from cars to more sustainable and active means of transport.

For new design and build projects, to meet the longer term TfGM targets for emissions reduction there is an urgent need to design staff accommodation that is significantly more energy efficient than the minimum acceptable emissions standard required to pass building controls. For example much greater levels of solar PV electricity generation of electricity are required on the new Bus station / Interchange projects, together with local electricity battery storage.

Hence, more ambitious carbon emissions reductions require design intervention at the RIBA level 1 and level 2 stages, as the building fabric and methods of naturally cooling a building needs to be seriously considered.

## How will we deliver?

- Project Management Services (PMS) have a significant role to play in terms of sustainable building designs. New CO<sub>2</sub> reduction targets will need to be agreed for TfGM to achieve its emissions reduction targets.
- To enable TfGM to build low carbon buildings such as Transport Interchanges then the use of the existing TfGM sustainability toolkit should not be in isolation. To ensure a good design for a low carbon building, PMS will need to further consider the environmental impact at the building concept design stage. Investment grade proposals will need to be proposed at the project inception stage by PMS to meet the TfGM emissions targets identified
- By utilising these prospective saving, a NPV (Net Present Value) whole life cost model should be developed to produce an investment grade business case for the installation of solar and battery store systems at the larger suitable facilities management sites.



- In terms of targets for sustainable building designs which are project managed by PMS, the following guideline targets will need to be followed for TfGM to achieve its emissions reduction targets:
  - All new buildings and transport infrastructure projects to be commissioned to exceed by 35% the Part L2A targets for carbon emissions
  - PMS must adopt the use of CIBSE TM54/39 guides that need to be used during the design stage to allow energy usage comparisons to be made for the post occupancy period
  - It will be key that PMS commissioning team continue their project work through to the post occupancy evaluation period, where all new buildings will be required to perform to within 5% of the energy predictions
  - In addition to the use of the TfGM sustainability tool kit, then NPV whole life cost investment appraisals should be detailed for proposed emissions reduction schemes for each PMS built project and then closely scrutinised to identify the longer-term cost benefits.
  - To make whole life cost savings a separate 'carbon reduction-invest to save fund' need to be made available to the PMS Project Managers for them to make the required investment into any new build scheme. This additional money will be above and beyond the original budgeted turn-key build project cost. The board agreement for any new money will require an investment grade proposal from PMS project management team for each individual build
  - TfGM will therefore incorporate ambitious targets for sustainability in all major infrastructure schemes, and will ensure designs consider and employ best practice, for example climate adaptation measures when risks are identified.
  - This will be achieved through utilisation of TfGM's Sustainable Assessment Tool (SAT). This is a tool that assesses project designs against a collection of environmental standards including those in the BREAA and CEEQUAL assessment process. TfGM's aim is for future projects to be rated as "High" or above using the SAT.

## Construction

- TfGM will seek to work with its principle contractors to improve quantification and monitoring of project impacts and to design out adverse effects of any construction

## Biodiversity

TfGM recognises the importance of improving the natural environment in Greater Manchester.

TfGM's Biodiversity Policy aims to improve the quality of life for transport users and non-transport users alike; and to promote a healthy natural environment through:

- Habitat conservation and enhancement;
- Management of invasive non-native species;
- Community engagement and partnership working;
- Control the use of environmentally damaging substances and materials and processes; and
- Improving and sharing information.

## 4. Waste

GHG emissions result from the collection and transportation of waste and from fugitive emissions arising from landfill. The gas from landfill waste includes methane, which is a potent greenhouse gas 23 times more damaging than CO<sub>2</sub>.

### How will we deliver?

- TfGM will seek to reduce the amount of waste it creates and divert waste away from landfill by the reuse and recycling of materials. TfGM's waste emissions are not significant, however, currently only waste that is produced directly is monitored.
- TfGM's environmental management system sets targets for recycled material and reductions in waste in projects and monitors the performance of waste reduction across all sites.
- TfGM will seek to improve its waste performance by considering the lifecycle and disposal costs in purchasing and will work with its contractors to implement a waste strategy to improve waste segregation and recycling at all sites.

## 5. Water

Water should be considered and managed as a precious resource. In 2016-17, TfGM consumed over 19,000 cubic metres.

The management, distribution and disposal of water contributes to the overall carbon footprint of TfGM. TfGM should consider the many opportunities to recycle water on sites.

### How will we deliver?

- Water cost and consumption will be measured, monitored and reported annually. Data will be analysed to target inefficiencies and leaks.
- Internal water audits to identify sites for grey water facilities (older sites) and water efficiency recommendations
- Efficient use of water should be integrated into building developments at the design stage.

## 6. Procurement

Sustainable procurement has an important role in reducing GHG emissions, for example when TfGM purchases equipment or contracts external providers to build new infrastructure there are opportunities to address environmental and social concerns and set higher standards for environmental performance.

### How will we deliver?

- TfGM aims to engage with its key suppliers and organisations and will look to include high standards for sustainability in all purchasing decisions. This will be achieved by embedding sustainability into procurement processes and gateways. Purchasers will have access to a sustainable procurement toolkit that will be utilised to assess the impacts of supplying and operating the potential product or service. The toolkit is designed to assist with a whole range of purchasing decisions from low to high values. For example, small purchases should where possible adhere to Government buying standards or “quick wins” whereas higher value purchases should assess a series of impacts such as ongoing energy and water demand, lifecycle emissions, waste disposal along with the impact on expected climatic effects.

Sustainable procurement will affect our carbon emissions scopes and targets in the following ways:

- Scope 1 & 2 emissions – Actively reduce the usage of energy from TfGM owned buildings, appliances and vehicles by procuring the most energy efficient products where possible.
- Scope 3 emissions – Ensure that suppliers have adequate measures in place to report on the supply chain and lifecycle emissions from the goods and services supplied. TfGM will engage with individual key suppliers to assist where possible in reducing their organisational and product carbon footprint.
- The toolkit should encourage utilisation of Eco labelling schemes to select products that have been assessed for performance and embedded emissions.

## **7. Organisational and workforce development**

To implement this Carbon and Energy Strategy the following business functions need to be implemented:

- Future leadership development should take account of the organisational and individual competencies required to deliver carbon reduction. TfGM should consider including sustainability and carbon governance as a responsibility on all job descriptions for Chief Executives and Director level posts.
- The Environment Delivery Group (EDG) is to endorse the proposed Carbon reduction projects and to ensure that committee representatives give their full support for projects being implemented within their own areas of the business.
- To ensure that the Carbon and Energy Strategy seamlessly fit into and is aligned with the other TfGM business strategies. In addition, to ensure that all other TfGM strategies and plans align with the same objective to reduce carbon emissions.
- The EDG need to develop departmental Key Performance Indicators (KPI's) for carbon reduction. Then to publish these KPI's on a new TfGM Carbon and Energy Performance intranet page. This intranet page will be used to demonstrate to staff that reducing the monthly CO<sub>2</sub> emission is the same akin to reducing the monthly operational cost
- To obtain approval for the appointment of a 'Energy Project Manager' within PMS

- Metrolink continue to monitor KAM's development of its energy management plan throughout the transition period, whilst working collaboratively with them to ensure TfGM's recommendations are considered and included where appropriate.
- PMS Mechanical and Electrical specialist to continue to develop a pilot 'Solar and Store' project at the Bolton Interchange.
- A milestone plan needs to be developed to show the measurable reduction in CO<sub>2</sub> emissions, for each department, resulting from the implementation of projects that are to be delivered during the period 2016/17 until 2020/21.
- To obtain investment board approval to seek funding using a 'spend to save budget' for the proposed carbon reduction projects
- The Carbon and Energy Project Managers need to develop a monthly carbon reports that shows the variance departmental emissions, which are reported regularly to Environment Delivery Group (EDG) and Environment Committee
- For each carbon reduction projects implemented, both the forecast and achieved emissions reductions need to be regularly reviewed and reported on using highly robust verification and validation tools

### **Communication and behaviour change**

TfGM recognises that a significant inefficiency can be avoided by changing people's behaviour. In addition, raising staff awareness and encouraging people to change their habits is an extremely cost effective investment, requiring minimal funding for a significant return. TfGM therefore considers investment in an effective communication, awareness and training campaign to be an integral aspect of this carbon strategy.

### **Objectives**

- Establish a clear, shared understanding of the strategy's vision and goals
- To promote carbon management awareness to all members of TfGM
- Generate enthusiasm for carbon management

- Improve readiness for change amongst staff that may be impacted by the carbon management programme, through changes to working practice etc.
- Enable early recognition of risks and issues so that strategy can be adapted where appropriate.
- Ensure accurate information and guidance are provided at the right time to maintain carbon management as a core issue in all TfGM activities.

### Audiences

- Stakeholders – GMCA, Districts, Energy providers, Carbon Trust, bus operators, hauliers
- Staff - At all levels
- Local Community
- Other interested parties - Other transport bodies, PTEG, local transport providers

### Key Messages

- All staff can make a difference to reducing carbon emissions.
- Reducing carbon emissions as part of the fight against climate change should be a key priority for publicly funded bodies, both to set an example and to provide the solutions.
- This activity ties in with the Paris agreement and TfGM's environmental policy.
- There is a considerable cost savings potential for TfGM.
- Action on carbon will enhance TfGM's position as an environmental leader
- Messages need to be added as the campaign develops in terms of precise actions that staff and stakeholders can take, e.g. a call for action, or minimising the impact of transport.

## 8. Role of partnerships and networks

TfGM will ensure that it does not produce an action plan that is in isolation the ten authorities within the GM Combined Authority, and that the pooling of resources and sharing ideas from the other authorities is not overlooked.



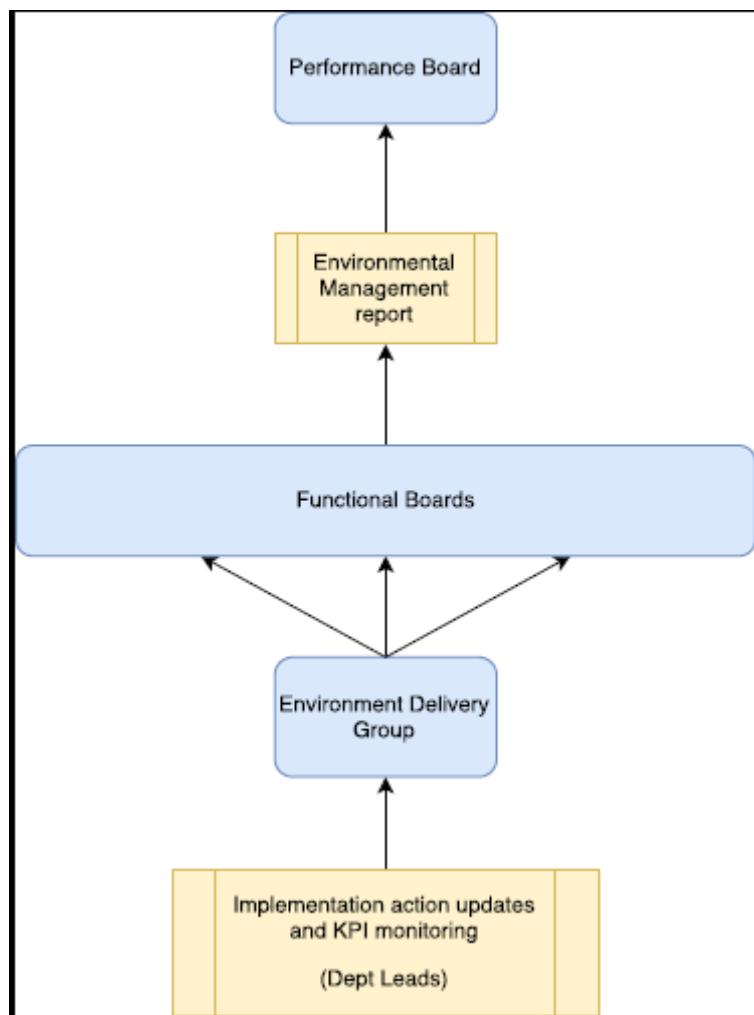
The proposed roadmap solutions will need to consult a wide group of stakeholders, in particular this process should engage the combined authority through the Low Carbon hub.

TfGM should use its leverage within local partnership and performance frameworks to promote carbon reduction. Alongside public sector partners, it should also seek to be an exemplar to other sectors and other transport authorities.

## 9. Governance

Carbon reduction and sustainable development are becoming corporate responsibilities for all organisations. As such, they should both be part of the formal objectives and governance arrangements at TfGM.

All TfGM staff are stakeholders in this strategy, however particular functional areas are responsible (see Appendix 3) for the delivery of actions and monitoring and reporting of KPIs. These functional areas will be expected to report on progress and performance through the following arrangement:





As roadmaps are developed these actions will need to include other measures of direct and indirect carbon emissions. This will be based on the agreed reduction target by 2015, established by this strategy.

## 10. Finance

Reducing the carbon impact of TfGM promotes the sustainability and resilience of the transport system by:

- helping TfGM to comply with forthcoming legislation and financial incentives
- keeping costs down by reducing the demand for, and increasing the efficiency of, energy use at TfGM
- increasing the resilience of TfGM against unpredictable energy supply and prices
- advertising the sustainability credentials of TfGM as a public sector exemplar

The financial system supporting TfGM needs to be updated to ensure that capital can be funded to take advantage of the longer term gains of innovative and truly sustainable and low carbon projects.

Therefore an investment case metric needs to be agreed where the investment should be agreed based on X tCO<sub>2</sub> reduced per thousand pounds invested.

Once metrics are agreed project managers and/or action leads will be required to make an internal funding application a proposed new dedicated 'TfGM invest- to-save CO<sub>2</sub> cost reduction budget'.

To manage performance TfGM must ensure that a robust verification procedure is put in place to verify the forecast carbon reduction targets are being achieved. It is highly recommended that the International Protocol for Monitoring and Verification (IPMVP) be adopted by TfGM for quantifying the success of all delivered Investment grade carbon reduction measures

## Conclusions and next steps

Beyond the recommendations and actions in this strategy, further programmes of research will be necessary to understand how a public sector organisation like the TfGM can achieve an 80% reduction in carbon emissions by 2050.

Current carbon and sustainable development metrics fall short of the requirements to review and monitor the different elements contributing to all direct and indirect carbon measurement let alone sustainable development indicators.

- TfGM will continue to develop the most appropriate metrics to measure and monitor direct and indirect carbon footprints and translate them into trajectories and milestones for TfGM to meet targets.

Scenarios for low carbon societies have been developed by many external organisations. In particular TfGM should seek to follow TfL's lead on producing a low emission road map that incorporates a strategy for reducing third party emissions, particularly bus mileage.

- TfGM will lead the development of a separate Transport Emissions Roadmap which specifically targets Bus fuel emissions and other similar transport assets. This work is beyond the scope of this strategy.

To become a public sector leader, or even meet the government's aspirations, will require transformational thinking and action on how the core business of TfGM is delivered in the next 40 years. In particular energy consumption and cost presents a key risk, but also an opportunity to innovate and support the development of low carbon technologies.

- This strategy identifies potential solutions for reducing the CO<sub>2</sub> emissions by circa 1,596 tCO<sub>2</sub> at FM sites. The capital cost for these projects are £2.5m, which will pay back on average over 5 years. The forecast reduction of 1596 tCO<sub>2</sub> emissions equates to approximately 3.8% reduction in the total TfGM emissions.
- The FM department need an additional resource, where a Building Services Energy Engineer is required to assist in the implementation of the new energy and carbon reduction schemes identified within section 1.

Without TfGM targeting the Metrolink traction electricity usage then it is difficult to see how future electricity consumption cost can be controlled. Unless Metrolink carries out this work then targets set by the Greater Manchester Combined Authority will not be achievable.

- This strategy identifies a TfGM resource requirement to recruit a full time Metrolink Carbon Reduction Project Manager. This role would be instrumental in producing a carbon reduction implementation plan for the Metrolink network.
- For any new carbon reduction proposals to be taken forward, then this strategy report needs to align with other organisational proposals and also dovetails into other the Metrolink and PMS departmental business strategies.



## Glossary of terms

BAU	Business as Usual scenario in which the estate grows as planned and there is no concerted attempt to reduce CO2 emissions
EMS	Environmental Management system
NPV	Net Present Value, a single figure representing all the future costs and incomes at their equivalent present value.
BIS	Department of Business, Innovation and Skills, a government department that succeeded the Department for Energy and Climate Change.
Carbon Trust	Government body charged with reducing CO2 emissions, funded by Climate Change Levy on bills.
CO2	Carbon dioxide emissions excluding other global warming gases
CO2e	Carbon dioxide emissions equivalent of six global warming gases including carbon dioxide
IPCC	Intergovernmental panel on Climate Change – the world's leading international body on climate change. Its function is to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts.
UTC	Urban Traffic Control – a service function of TfGM that oversees traffic management
TfGM	Transport for Greater Manchester
KAM	Keolis-Amey, the current operator of the Metrolink service.

## Appendix

A1: An illustrative breakdown of TfGM Scope 1, Scope 2 and Scope 3 emissions

A2: Carbon Calculations and methodology

A3: Environmental Committee role and responsibility matrix

### **Appendix A1: An illustrative breakdown of TfGM Scope 1, Scope 2 and Scope 3 emissions**

With the ever-rising energy costs and the sustained growth in the TfGM transport infrastructure network, then the TfGM operational costs relating to Scope 1 & 2 emissions are set to rise dramatically over the life of this emissions reduction plan.

Scope 1 & 2 emissions are part of the greenhouse protocol that relate to direct emissions which are in the form of natural gas used for the heating systems, and any refrigerants released to the atmosphere because of TfGM operating its air condition systems. Indirect emissions relate to the use of all electricity from the national grid.

Scope 1 includes any emissions under the direct control of TfGM:

- Gas used for heating buildings
- Oil used for heating buildings
- Fuel used in TfGM owned vehicles
- Fugitive emissions of other global warming gases lost in maintenance of air conditioning.

Scope 2 includes indirect emissions at power stations caused by use of electricity:

- Metro link electricity
- Office and depot electricity
- Bus stop electricity
- Traffic signals electricity



Scope 3 includes emissions not under the direct control of TfGM but occurring because of TfGM activities such as:

- Business travel including hire cars, flights and public transport
- Waste disposal
- Water use
- Losses from transmission and distribution of electricity

## **Appendix A2: Carbon Calculations and methodology**

Carbon emissions is shorthand for carbon dioxide emissions equivalent (displayed as CO<sub>2</sub>e). Carbon dioxide emissions are emitted when any fuel is burned and are categorised under three headings or scopes by the World Resources Institute. Emissions of five other global warming gases such as methane and refrigerants are included using a conversion factor to give the equivalent global warming potential to

Carbon emissions from fuel use are calculated by applying the appropriate carbon conversion factor to the energy used as metered. This assessment uses the latest set of conversion factors set by DEFRA.

A range of different factors are used for other emissions sources based on their unit of measurement. A full set of the factors used is available at DEFRA's web portal. The recent recalculation applied the appropriate conversion factors to the past year's data.

### **Baseline Adjustment**

TfGM's operations and estate are not static; assets are sold, refurbished and expanded. The organisation has established a recalculation policy, which in summary necessitates baseline recalculations to be made when the organisation makes an acquisition or disposes of operations that existed in the baseline year. This excludes activity that is to be considered as organic growth or decline.

In 2010, TfGM acquired the responsibilities for Urban Traffic Control (UTC) across GM. UTC provides a comprehensive maintenance function for the traffic signal network, this is made up of around 2,400 installations.

The energy used through these installations for traffic signals and speed cameras has been backdated and included in an adjusted baseline. However the accompanying increase in resources such as building energy and staff travel have not been backdated due to the lack of available data.



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Other changes to estates such as new interchanges at Rochdale, Wythenshawe and Altrincham have not been included in baseline adjustments. Although the size and some purposes may have altered, the function remains broadly similar to the original structures.

### A3: Environmental role and responsibility matrix

Environment Indicator	Department	Action Owner	Strategic Objective (ECIP)	Targets	KPI
<b>Energy*</b>	Facilities Management & PMS Metrolink	Howard Hartley/Alex Cropper  Daniel Vaughan	Reduce total energy use and costs across TfGM sites	15.5% reduction in FM property  Metrolink TBC	kWh (per quarter)
<b>Waste</b>	Bus - Facilities Management	Howard Hartley	Increase recycling rates & minimise waste	Increase recycling rate to 50% by 2021	% of recycled waste (Annual)
<b>Water</b>	Bus – Facilities Management	Howard Hartley	Improve water efficiency and control	Reduce water usage by 5% by 2021	Total cubic meters (M <sup>3</sup> )
<b>Fleet</b>	Bus – Facilities Management	Howard Hartley	Increase fuel efficiency	All new fleet vehicles to meet low emission standard. 10% to be zero emission	MPG, % of low emission vehicles (annual)
<b>Staff Travel</b>	Travel choices	TBC	Elimination or reduction of travel by high emission modes	% of staff travelling to/for work by low emissions modes	% staff travelling to work by car
<b>Project design</b>	Project Group	Alex Cropper	To achieve best practice in sustainable design and construction	All new projects achieve minimum of "Good" standard or above in SAT by 2020/1	% of projects achieving SAT
<b>Procurement</b>	Procurement	Frank Tudor	Reduce the impact of embedded resources and emissions.	100% of all OJEU SSD contain assessment using Sustainable procurement toolkit. (SPT)	No of purchases using SPT
<b>Biodiversity</b>	Safety & Compliance	Chris Thorpe	Maintain existing natural capital and biodiversity as a minimum and enhance where possible	To meet the requirements of the Biodiversity Duty	-
<b>Pollution prevention</b>	Safety & Compliance	Chris Thorpe	Achieve 100% compliance with ISO14001	Nº of compliance failures (annual audit)	0 Major non-conformances
<b>Resources</b>	Safety & Compliance	Chris Thorpe	Reduce paper consumption per person	To reduce paper consumption	Kg paper consumed
	Property services	Howard Hartley	Elimination of operational greenhouse gas emissions	Zero Fgas emissions	Kg of Fgas
<b>Emissions</b>	Logistics, Environment & Active Travel	Helen Smith	Reduction of both Green House Gas and regulated emissions.	Accurately report required annual emissions	Tonnes CO <sup>2</sup> e (annual)



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