



Glasgow City Council

Net Zero and Climate Progress Monitoring
Committee

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Neighbourhoods Regeneration and Sustainability

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Item 7

8th August 2023

UPDATE ON CITYWIDE CO₂ EMISSIONS

Purpose of Report:

To provide Committee with an update on the latest data with regards to CO₂ emissions in the city.

Recommendations:

The Committee is asked to:

- 1) Note the contents of this report;
- 2) Note that this report will be updated annually.

Ward No(s):

Citywide: ✓

Local member(s) advised: Yes No ✓

consulted: Yes No ✓

1. Introduction

- 1.1 The Department for Energy Security and Net Zero (DESNZ), formerly the Department for Business, Energy and Industrial Strategy (BEIS), releases data on energy consumption and carbon emissions for local authorities annually, two years in arrears. The data available from DESNZ is updated due to changes in the carbon equivalent of energy generation each year and the changes backdated from its previous releases.
- 1.2 This report updates the carbon emissions for Glasgow based on the most recent data, covering the year 2021.

2 Background

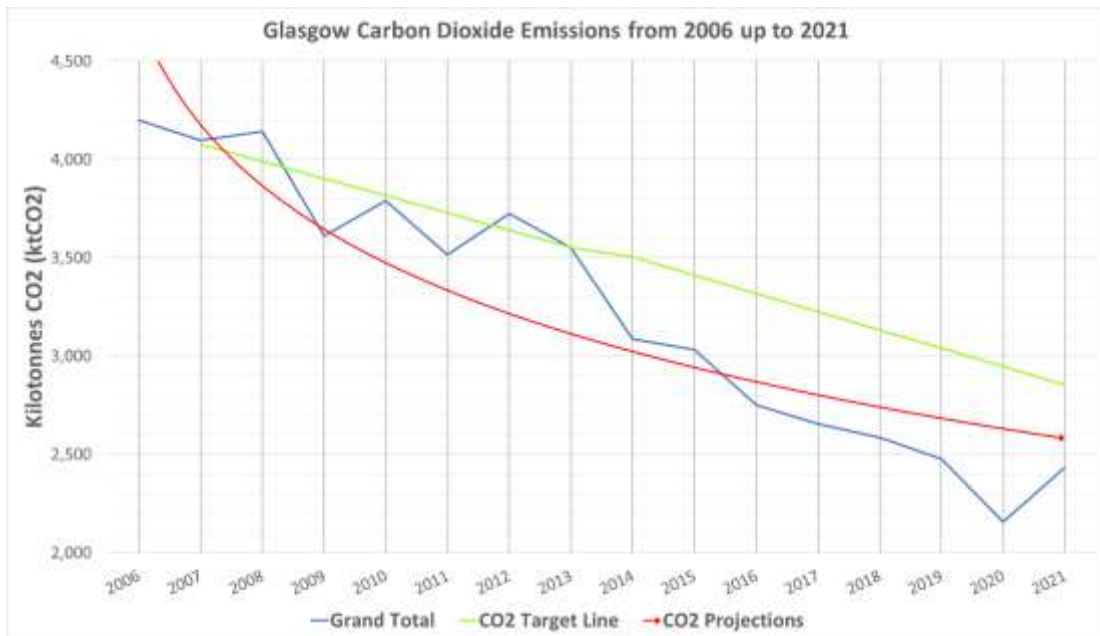
- 2.1 It should be noted that this paper only assesses emissions in the city from Scope I and II. Scope III emissions have not been quantified to a degree yet reliable at this point due to absence of a consistent and agreed methodology or baseline for comparison. An agreed method for quantifying Scope III emissions is being explored by Glasgow City Council.
- 2.2 The previous report to Committee in respect of citywide CO₂ emissions detailed the annual data for 2020, a year significantly impacted by the introduction of restrictions due to the pandemic. Whilst some pandemic restrictions continued into 2021, overall this year was much less affected and it was expected that this would be reflected within the emissions data.
- 2.3 This report will outline and analyse the profile of the changes to Glasgow's CO₂ emissions in 2021, with comparisons against both baseline and the previous year's emissions as is usual practice. However, due to the unusual nature of the emissions in 2020, comparison will also be made where appropriate with the last pre-pandemic year of 2019.

3 Results: Analysis of Emissions Data (2021)

- 3.1 Glasgow's CO₂ emissions in 2021 totalled 2,435 kilo-tonnes¹ of carbon dioxide (ktCO₂). This represents a **12.8% increase** from the 2020 total of 2,158 ktCO₂ and a **42% decrease from a 2006 baseline**. This also represents a **1.8% decrease** from the 2019 total of 2478 ktCO₂.
- 3.2 The trajectory of Glasgow's CO₂ emissions reduction is visually represented in Figure 1, noting that Glasgow met the interim target of a 30% reduction in carbon emissions by 2020 from the baseline year (2006). It is also noted that Glasgow has reduced its emissions by 1,765 ktCO₂ (42%) between 2006 and 2021 and remains ahead of target.

Figure 1 - Carbon Emissions Reductions 2006-2021

¹ 1 kilotonne (kt) is equal to 1,000 tonnes



- 3.3 The data as reported previously outlined that in 2020 Glasgow hit a milestone figure of reducing its emissions by 50% from baseline. This was a significant achievement but one that came with strong caveats due to the impacts of the pandemic. The recovery from the pandemic and lessening of related restrictions has resulted in emissions increasing in 2021 by 12.8% compared to 2020 but maintaining a 42% reduction from the 2006 baseline.
- 3.4 The 1.8% reduction in emissions in 2021 compared with 2019 represents a decline in the rate of decrease. This can be seen in Figure 2 below which shows the projected reductions based on the pre-pandemic trend. However, overall reductions remain 14.7% ahead of target as can be seen in Figure 1 above.

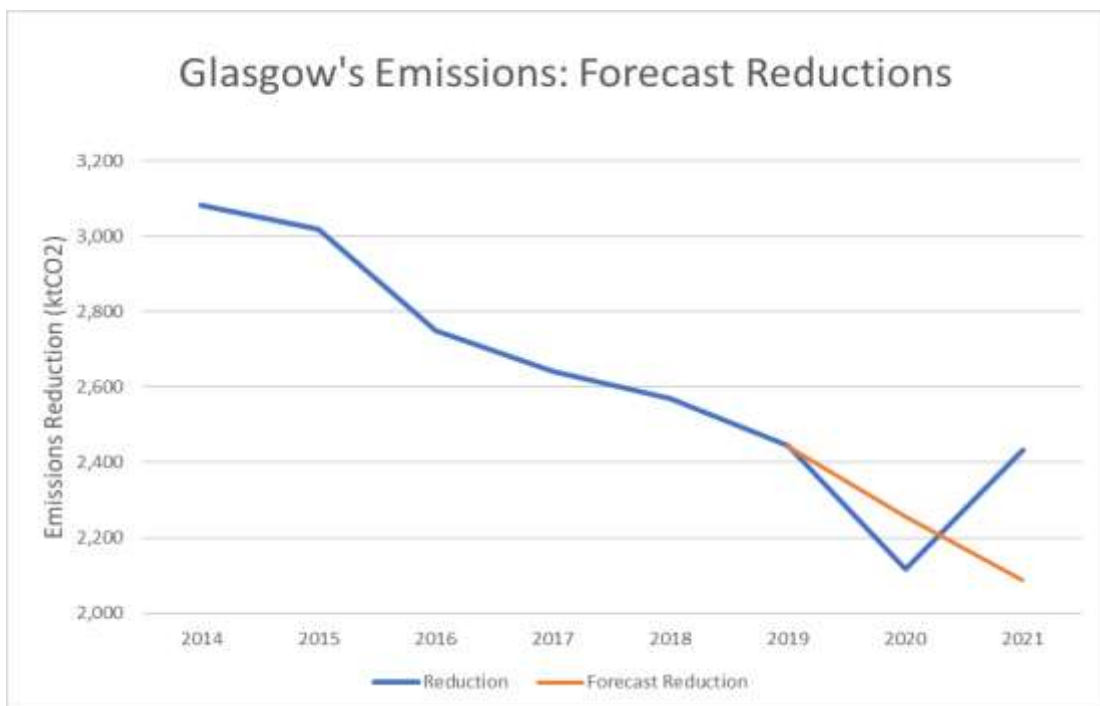


Figure 2 - Glasgow's Emissions: Forecast Reductions

3.5 Whilst maintaining the emissions reductions experienced in 2020 was always highly unlikely due to the specific circumstances which applied in that year, the overall increase in emissions experienced in 2021 is higher than expected with sector specific increases within the total requiring additional investigation and explanation.

4. Sectoral Emissions

4.1 Glasgow's carbon emissions can be broken down into sectors to allow for further analysis. The sectoral profile for the period 2006 until 2021 can be found in Figure 3 below.

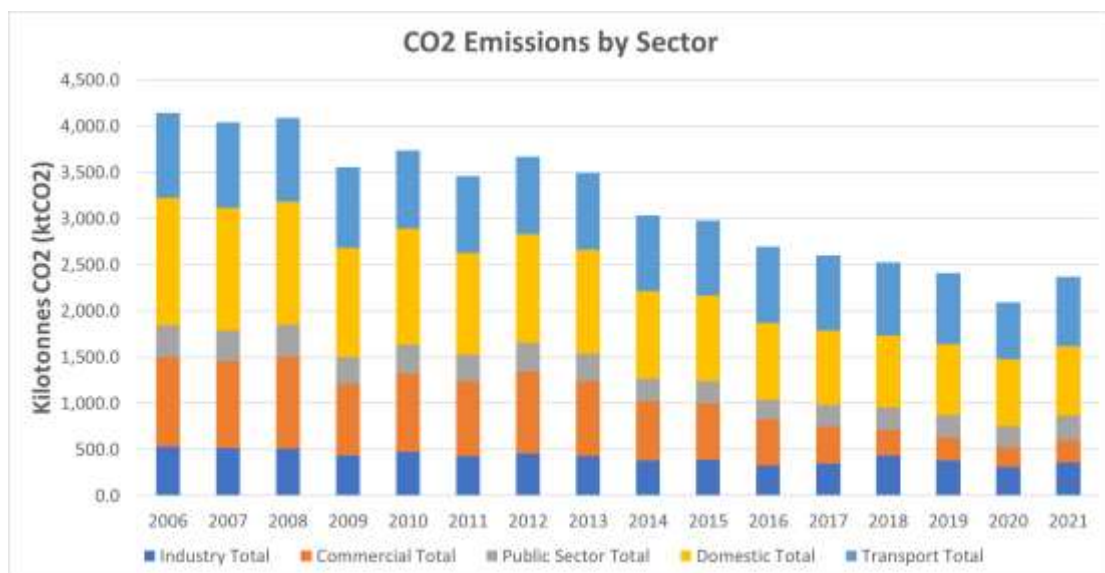


Figure 3 - Sectoral Emissions

4.2 The changes in sectoral emissions between 2020 and 2021 are outlined below:

- The domestic sector: 33.4 ktCO₂ increase (4.6%)
- The transport sector: 132.6 ktCO₂ increase (21.4%)
- The industrial sector: 46.9 ktCO₂ increase (15%)
- The commercial sector: 30.1 ktCO₂ increase (14.5%)
- The public sector: 32.2 ktCO₂ increase (13.7%)

4.3 Figure 4 below displays how rises in Transport related emissions in 2021 contributed overall to Glasgow's total emissions increase. Transport emissions represent both the largest absolute sectoral increase and also the largest percentage increase.

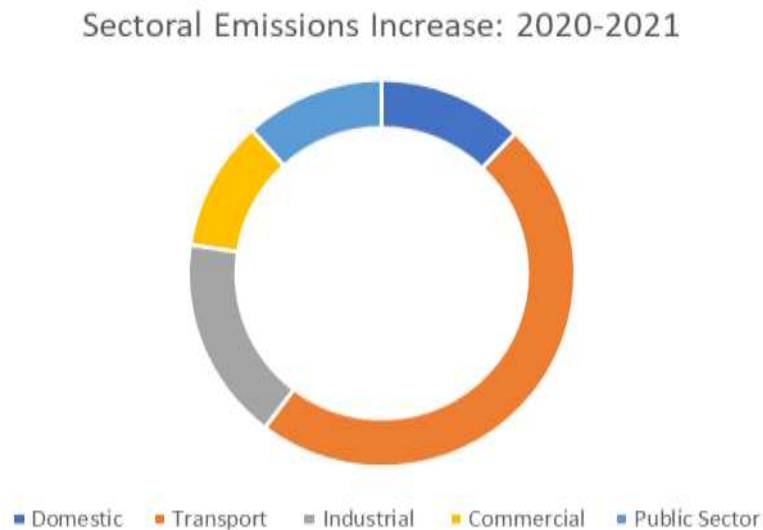


Figure 4 - Sectoral Emissions

4.4 The emissions trend and sectoral mix represented in Figure 3 alongside the figures in 4.2 are indicative of the impacts of recovery from the pandemic with the transport sector witnessing a greater than 20% increase in emissions. Transport emissions are discussed further in Section 5.

4.5 As 2021 observed a significant lessening in both the nature and duration of the pandemic restrictions, this was reflected in the recorded emissions. Industrial and commercial emissions both rose by approximately 15% as offices, shops, and hospitality venues resumed more normal activities. These findings are analysed later in this report.

4.6 Public sector gas emissions have not significantly reduced in recent years in Glasgow and have increased in both of the pandemic affected years of 2020 and 2021.

5. Source Emissions

5.1 Figure 5 below outlines the trajectory of emissions reductions by source from the 2006 baseline, showing the 2021 increase in gas and electricity emissions with the largest increase coming from transport emissions.

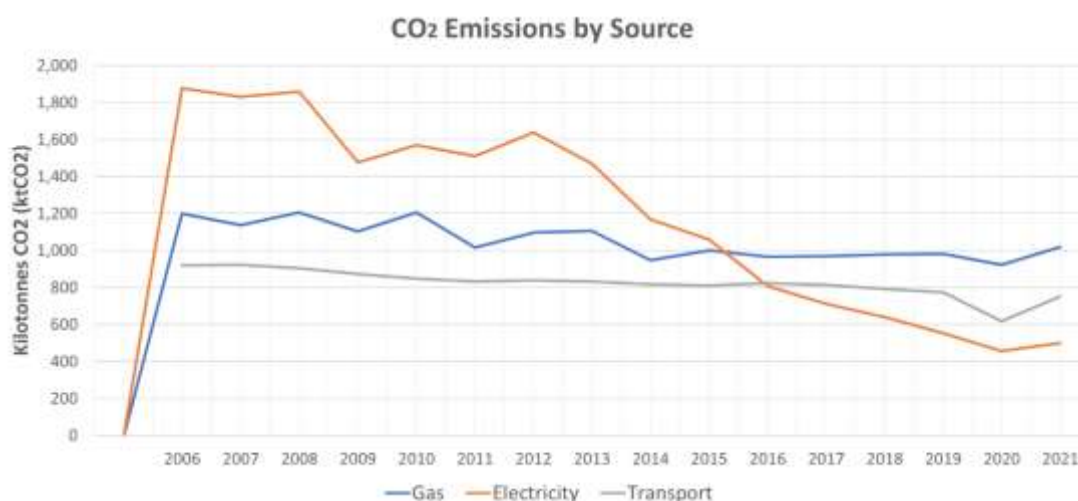


Figure 5 - Emissions by Source

5.2 Transport Emissions

5.2.1 As mentioned in Section 4, transport emissions rose significantly in 2021 by 21.4% compared to 2020 and by 2.9% over the pre-pandemic year of 2019.

5.2.2 Analysis of the transport emissions reveals a wide gap in the emissions growth between different road types. Emissions from motorways and A-roads increased by 14% between 2020 and 2021. However, emissions from minor roads increased by 38.4% over the same period.

5.2.3 The increase in minor road emissions may be attributable to the lessening of pandemic restrictions and the allowance of local journeys and travel. Increased work and leisure activities and allowance for visitation of friends and family may also have contributed to local travel. This indicates that Glaswegians were taking more short distance trips, which matches up with the guidance to stay within the area in which you lived during restriction periods. Increased levels of home delivery may also be a contributing factor to local traffic increases. However, emissions from minor roads also rose by 17.3% over 2019 pre-pandemic levels and further analysis of the contributory factors to this increase is required.

5.2.4 Whilst emissions from motorways and A-roads increased by 14% between 2020 and 2021, in contrast with minor roads, emissions remain 11.1% below 2019 levels. Emissions from these road types may be more closely influenced by general economic activity which remained restricted by pandemic measures during 2021, however further analysis of the contributory factors is required.

5.2.5 The pandemic and the resulting lockdowns also instigated the launch of the Council's Spaces for People programme in 2020. This delivered a significant number of temporary travel interventions across the city to ease physical distancing in public places, mainly through the provision of widened footways,

road closures and segregated cycle lanes. These continued throughout 2021 and the majority of these have been made permanent, with improved infrastructure, following an independent review which highlighted the long-term active travel and sustainability benefits.

- 5.2.6 Glasgow also continued to progress ambitions to create a Low Emission Zone in the city during 2021. A key output from this is a greener fleet of buses covering the city centre and beyond with 80% of bus journeys required to meet the LEZ emission standards by the end of 2021. Supplementing the increased number of buses meeting the LEZ standards, operators within the city continued the move to transition their fleets to zero emission vehicles through business investment and funding from the Scottish Ultra Low Emissions Bus Fund (SULEBS).
- 5.2.7 A number of actions are being progressed to help address stubborn levels of transport related CO₂ emissions. The Council now has an updated suite of sustainable transport policies along with ambitious targets. The Glasgow Transport Strategy part 2 has highlighted trip avoidance, trip length reduction, and modal shift as effective means to reduce emissions. This is also supported by progress in active travel infrastructure, such as East City Way completed in 2023. Work continues on bus priority infrastructure through Bus Partnership Funding & enhancing bus infrastructure in the city every year through SPT capital funding.
- 5.2.8 A similar pattern can be seen in the transport emissions data from other local authorities. Figure 7 displays the increase in transport emissions across the four key authorities, a further indication that external factors such as the recovery from the pandemic were most likely responsible.

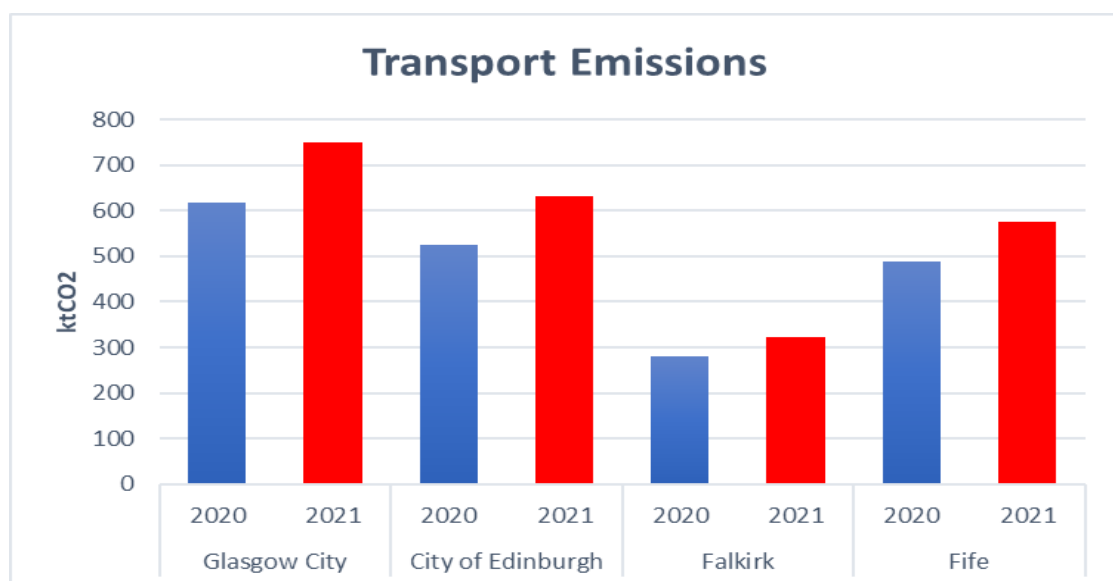


Figure 7 - Transport Emissions Across Local Authorities 2020-2021

- 5.2.9 Whilst policies relating to reducing transport emissions are having positive effects, the increase in traffic emissions from 2020 levels was higher than

expected and exceeded those of 2019. Further analysis is required of the transport emissions data to fully quantify the reasons for this increase. Based on 2021 figures, **Glasgow has reduced transport emissions by 18.2% from the 2006 baseline.**

5.3 Gas Emissions

5.3.1 **In 2021, gas emissions rose by 11.1%**, from 916.4 ktCO₂ to 1018.3 ktCO₂. Gas emissions have dropped 15% from the 2006 baseline..

5.3.2 The consumption of gas, fuel oil and electricity for heating is influenced by the external temperature and weather conditions. Hence, in Glasgow, there is variability between months from a seasonal perspective but there can also be variability between the same month in different years. Degree day analysis uses a simplified form of historical weather data to identify how much energy use buildings require to maintain a certain temperature when external temperatures drop below that threshold. This allows for the production of a weather adjusted energy use. Degree day analysis indicates that 2021 was 4.6% colder than in 2020.

5.3.3 Data in respect of gas usage emissions between 2019-2021 is highlighted in Table 1 below. The figures show an increase in these emissions across all sectors from 2020 to 2021 which can be explained in part through reductions in pandemic impacts and increased economic activity. However, emissions in respect of the commercial and public sector also increased on their pre-pandemic levels with the rises of approximately 20% over 2019 levels.

ktCO ₂	Industry Gas	Commercial Gas	Public Sector Gas	Domestic Gas
2019	182.2	57.2	176.2	565.4
2020	141.7	63.2	182.6	534.8
2021	175.1	69.1	210.3	563.8
20/21 Diff	+33.4	+5.8	+27.7	+29
20/21 Diff (%)	+23.6%	+9.2%	+15.2%	+5.4%
19/21 Diff	-7.1	+11.9	+34.1	-1.5
19/21 Diff (%)	-3.9%	+20.8%	+19.4%	-0.3%

Table 1- Disaggregation of Gas Emissions

5.3.4 Industrial gas emissions rose by a significant 23.6% between 2020 and 2021 but remained 3.9% below 2019 levels. Emissions from commercial gas rose by 9.2% between 2020 and 2021 and 20.8% above 2019 levels. This could be due to more commercial premises opening as the pandemic recovery progressed. Unlike for electricity (for which reporting years are more closely aligned to calendar years), the reporting year starts from mid-May, meaning more of the reporting year was free of pandemic restrictions. Increased ventilation measures may also have resulted in higher gas use to heat commercial buildings. Domestic gas emissions only increased by 5.4% bringing them back to approximately the same as their pre-pandemic level. Future domestic gas

consumption rates may begin to reflect the cost of living crisis and the significant rise in energy prices.

5.3.5 Public sector gas emissions also rose by a significant 15.2% between 2020 and 2021. This was in addition to the rise already experienced between 2019 and 2020, leading to an overall increase of 19.4% over 2019 levels. Similar increases were experienced in 2021 by other local authorities.

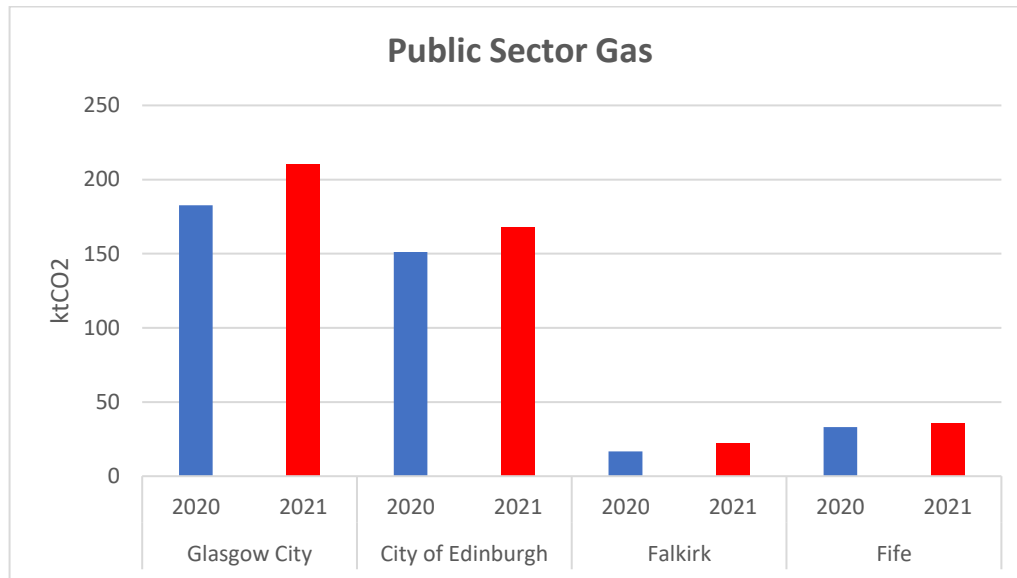


Figure 8 - Public Sector Gas Emissions Across Local Authorities 2020-2021

5.3.6 The report on the Council emissions from 2021 was presented to Committee on 20th September 2022 and reported that GCC emissions from gas usage had increased by over 10%, which corresponds at a slightly lower level with the overall public sector increase. Gas usage constitutes 48% of the Council's CO₂ emissions. This highlights the difficulty of decarbonising heat and illustrates the need for significant investment in zero and low carbon heat technologies. Work is ongoing at the city level to identify renewable heat sources and build heat networks that GCC buildings can connect to. This will be covered in the forthcoming Local Heat and Energy Efficiency Strategy that will be presented to this Committee later in 2023.

5.3.7 Increases in public sector gas use are a significant driver of the emissions increase. Possible factors include:

- More hospital wards being opened and used during the pandemic (vaccinations didn't really get to most of the population until Spring / Summer 2021).
- Vaccination centres operating in public sector buildings
- Running workplaces, schools and public spaces under Covid rules – increased ventilation causing heating systems to work harder.
- Running reduced occupancy workplaces, schools, and public spaces (making heating systems work harder to compensate for less body heat and use of appliances).
- Increased demand in the city's crematoriums in response to the challenges of the pandemic.

5.3.8 Heat networks can increase the heating efficiency of gas systems. Whilst the upcoming Local Heat and Energy Efficiency Strategy (LHEES) will seek to increase the amount of heat networks in Glasgow, there are already several heat networks operational in Glasgow including:

- **Hillpark Drive** - Opened in 2018, the Hillpark Drive heat network provides heating and hot water, via a 400kW air source heat pump, to a total of 350 social homes in the area through a network of underground and overground pipes almost 5km in length. The lower cost of energy has helped alleviate fuel poverty in the homes supplied by the network.
- **Athlete's Village** – Opened in 2014, for the Commonwealth Games, the Athlete's Village heat network supplies heat and hot water to 704 homes, the Emirates Arena, the Sir Chris Hoy Velodrome, a community centre, a nursery, and a 120 bed care home via a 1.68MW combined heat and power (CHP) plant.
- **University of Strathclyde** – Opened in 2018, the University of Strathclyde's heat network and CHP system reduces energy use for the University by around 25% compared to its previous system. The system required the installation of several kilometres of pipework and provides energy to 19 buildings on campus.
- **University of Glasgow** – Opened in 2016, the University of Glasgow's heat network connects 53 buildings on the Glasgow University estate to the new energy centre, which contains five boilers with a combined thermal capacity of 42 MW and a gas-fired CHP engine, producing 3.35 MW electricity and 3.25 MW of heat.
- **Wyndford Estate** – Opened in 2012, the heat network and 1.2 MW CHP system on the Wyndford Estate provides energy to 1,900 homes via around 2.7 kilometres of pipework.

5.3.9 Progress on reducing gas emissions can be difficult to quantify due to the impact of the weather. Alongside this, 2021 figures are complicated by the pandemic factors with increased usage expected as restrictions were eased. However, emissions from this sector are 15% below the 2006 baseline level.

5.4 Electricity Emissions

5.4.1 In 2021, electricity emissions increased by 9.6% from 2020, from 454.9 to 498.4 ktCO₂. **From our 2006 baseline, electricity emissions have dropped 73.4%**, having been 1,877 ktCO₂ in 2006.

5.4.2 As an increasing proportion of electricity comes from renewable sources, the overall carbon intensity of electricity reduces. This is quantified using conversion factors which highlight how much carbon is attached to each kWh of electricity used. In the 2021 GHG Conversion Factors, the **CO₂e factor has decreased (compared with 2020) by 8.9%**. Figure 9 below shows the breakdown of electricity consumption by fuel in Scotland in 2021.²

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<https://scotland.shinyapps.io/Energy/?Section=RenLowCarbon&Subsection=RenElec&Chart=ElecConsumptionFuel>

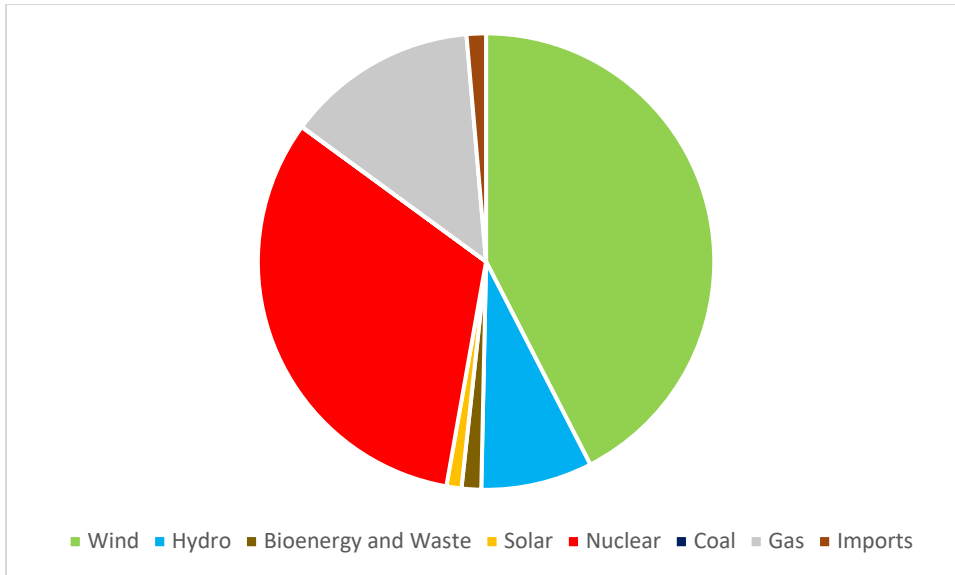


Figure 9 - Electrical Consumption by Fuel (2021)

5.4.3 The disaggregation of emissions from electricity are highlighted in Table 2 below. As expected, emissions from the industrial and commercial sectors increased significantly with smaller rises observed from the public sector and domestic sources. Similar to gas emissions, this is most likely due to increased economic activity as pandemic restrictions lessened. However, unlike with gas emissions, all sources continued to show a reduction in carbon emissions when compared with the pre-pandemic year of 2019. This is likely due to the continued decarbonisation of the grid supply.

ktCO ₂	Industry	Commercial	Public Sector	Domestic
2019	103.3	189.6	67.4	192.2
2020	81.6	142.2	52.2	178.8
2021	92.2	166.3	56.7	183.3
20/21 Diff	+10.5	+24.1	+4.5	+4.4
20/21 Diff (%)	+12.9%	+16.9%	+8.6%	+2.5%
19/21 Diff	-11.1	-23.3	-10.6	-8.9
19/21 Diff (%)	-10.8%	-12.3%	-15.8%	-4.7%

Table 2 - Electricity Emissions

5.4.5 Although a significant proportion of reduction tends to come from action a national level to decarbonise the grid, Glasgow has been instrumental in the uptake and utilisation of sustainable electricity where able to do so. Examples of this include:

- The opening of the Glasgow Recycling and Renewable Energy Centre (GRREC) which diverts household waste and create renewable heat and electricity. This was undertaken as part of the delivery of the city's Energy and Carbon Masterplan (ECMP).
- The installation of the 3MW wind turbine at Cathkin Braes, also delivered under the ECMP, continues to generate renewable electricity for the grid.
- Significant rollout continues of solar PV across the Council's estate, the private sector and also the domestic sector. Current Council plans to

accelerate this rollout, coupled with increased domestic, commercial and industrial installation partly as a result of increased energy costs, should contribute to future reductions in carbon emissions from electricity use.

6. Glasgow and other Local Authorities in Scotland

6.1 Analysis of the carbon emissions of all the Scottish Local Authorities in 2021, shows that Fife continues to have the largest carbon emissions (2,840.0 ktCO₂), followed by Glasgow (2,434.5 ktCO₂) Falkirk (2,122.9ktCO₂), and Edinburgh (2,077.6ktCO₂) as indicated in Figure 9 below.

6.2 Examination of the CO₂ per capita shows that Glasgow emitted 3.8 tCO₂ per capita in 2021 compared to 3.3 tCO₂ in 2020. This is lower than Scotland's average of 6.0 tCO₂ per capita and also slightly lower than our closest Scottish comparator, Edinburgh, which sits at 3.9 tCO₂ per capita in 2021. This is a positive indicator. However, these figures need to be tempered with the possibility that they could also reflect an increased rate of fuel poverty in the city resulting in lower usage.

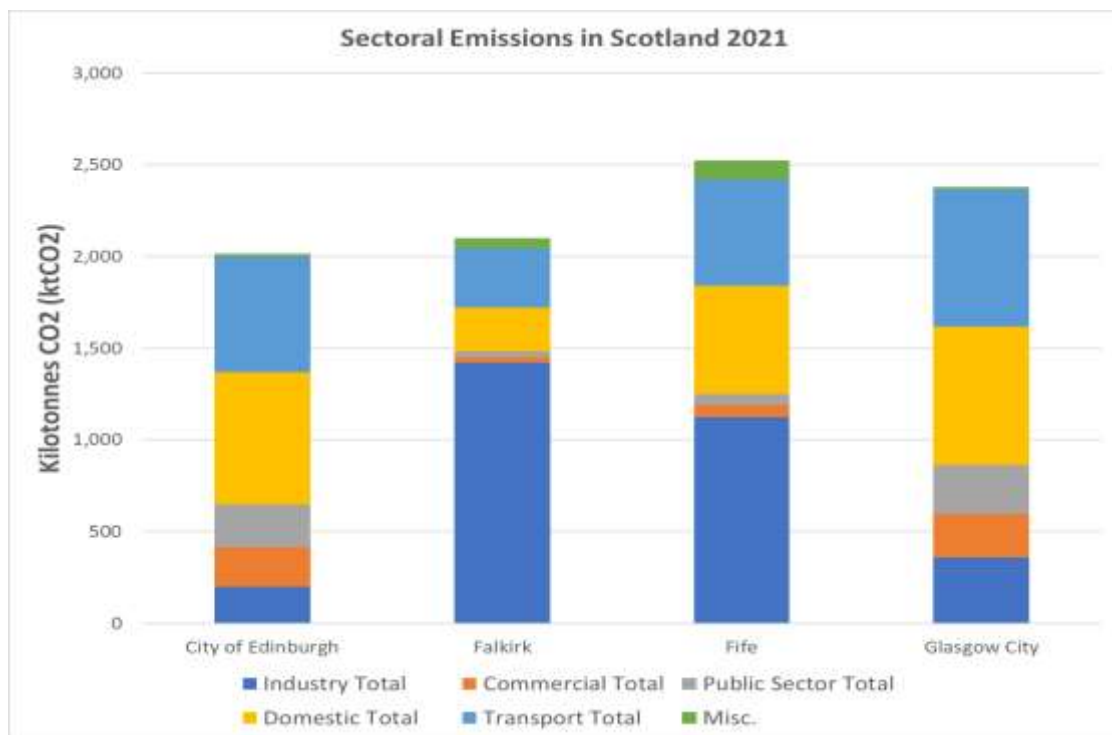


Figure 10 - Local Authority CO₂ Emissions (2021)

6.3 As well as the Scottish local authorities, comparisons have been undertaken between Glasgow and our fellow Core Cities UK partners which includes Belfast, Birmingham, Bristol, Cardiff, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield. The unexpectedly high increase in emissions observed in 2021 was a common feature across many of the Core Cities. Of particular interest was the increases in public sector emissions between 2019 and 2021 as shown in Figure 11 below.

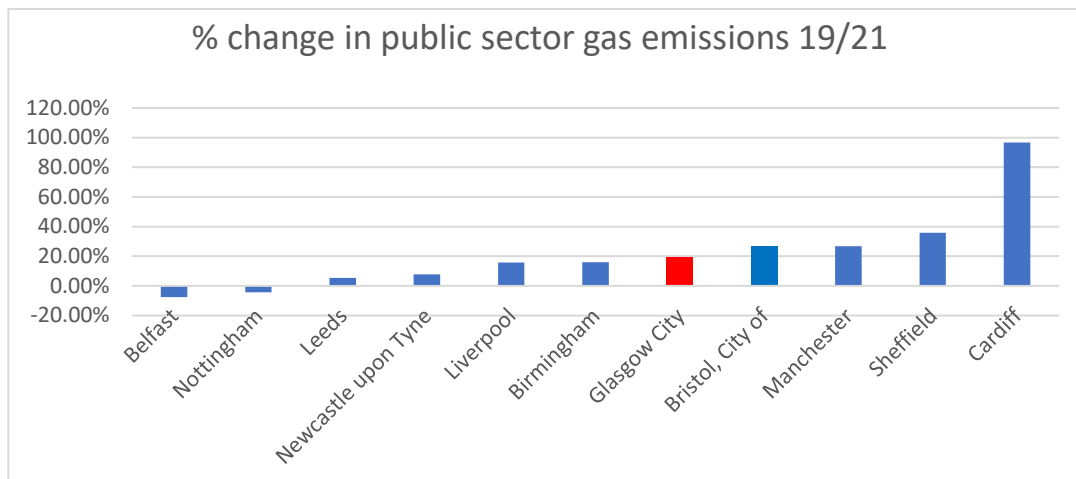


Figure 11 - % change in public sector emissions 19/21

6.4 As can be seen, Glasgow's increase in public sector emissions is comparable with the majority of the Core Cities, with Cardiff a significant outlier in terms of their increase.

7. Conclusions

7.1 With the impact of the pandemic in 2020, followed by continued restrictions into 2021, it is difficult to draw definitive conclusions with regard to Glasgow's progress in reaching the target of Net-Zero Carbon by 2030. With the lessening of restrictions in 2021, a rise in the absolute emission levels was always expected. However, the data for this year has shown some unexpected detail, including sectoral emissions which have risen faster than expected and, in the case of transport emissions, exceeded their pre-pandemic levels. Overall, **Glasgow's emissions increased by 12.8% from the previous year's figures but the city maintains a 42% reduction from our 2006 baseline.**

7.2 Nonetheless, policies and projects aimed at supporting Glasgow's transition to a net-zero city are having a positive impact. Increased EV charging and cycling infrastructure are creating an environment that is convenient for residents to make low carbon choices. Increased zero emission buses serving the city are also expected to contribute to carbon reductions from transport sources. Furthermore, Glasgow continues to contribute to the national shift toward renewable electricity with the continued rollout of solar PV across the estate alongside the contributions from other generation sources such as the GRECC and the Cathkin Wind Turbine. Heating and cooling in the city continues to decarbonise from our 2006 baseline with regional retrofit programmes and district heating expansion forming key parts of the city's approach moving forward.

7.3 Significant challenges remain for Glasgow in reaching its targets. A number of complex factors affect the decarbonisation of both transport and heating, whilst the importance of doing so only increases. Strategies such as the Glasgow Transport Strategy and the upcoming Local Heat and Energy Efficiency Strategy (LHEES) will seek to address these issues through a range of measures, including the expansion of heat networks in the city.

- 7.4 In addition to this, the trajectory of Glasgow's emissions reductions will inevitably be impacted by the calculation and inclusion of our Scope III emissions. Further work will be required to develop and adopt the appropriate methodology for inclusion of these emissions and the establishment of appropriate baselines, targets and reporting mechanisms.
- 7.5 The overall increase in annual emissions, although expected due to pandemic factors, highlights the need to continue to raise the pace and scale of climate action wherever possible, in particular around transport where decreases from baseline lags behind other sectors.

8 Policy and Resource Implications

Resource Implications:

<i>Financial:</i>	There are no new financial implications arising from the report.
<i>Legal:</i>	The report raises no new legal issues.
<i>Personnel:</i>	The Energy and Carbon Masterplan and Climate Plan for Glasgow are managed by the Sustainability team.
<i>Procurement:</i>	No relevant procurement issues.

Equality and Socio-Economic Impacts:

<i>Does the proposal support the Council's Equality Outcomes 2021-25? Please specify.</i>	Yes, the principles of emissions reduction are broadly supportive of all the Council's Equality Outcomes.
<i>What are the potential equality impacts as a result of this report?</i>	No impact from this report.
<i>Please highlight if the policy/proposal will help address socio-economic disadvantage.</i>	No impact from this report.

Climate Impacts:

Does the proposal support any Climate Plan actions? Please specify:

Yes. This report supports the Climate Plan ambition of attaining net zero carbon by 2030.

What are the potential climate impacts as a result of this proposal?

This report describes the cumulative reductions in carbon emissions until 2020. The progress demonstrated in this report contributes to less damage to the environment and contributes directly to lessening the pace of climate change.

This report also describes progress on efforts to reduce carbon emissions. Many of the projects currently underway, as well as those in development will help sustain existing and create new jobs and require investment, thus contributing to the growth of a greener economy in Glasgow.

Will the proposal contribute to Glasgow's net zero carbon target?

Yes. This report highlights the emissions of the city and supports the Climate Plan ambition of attaining net zero carbon by 2030.

Privacy and Data Protection Impacts:

No data protection or privacy implications. This report presents analysis of publicly available data and does not represent any privacy or data protection issues.

9 Recommendations

The Committee is asked to:

- 1) Note the contents of this report;
- 2) Note that this report will be updated annually.