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Business as usual Projections Report: Work Package 2

Report for Sheffield City Council

Customer:

Sheffield City Council

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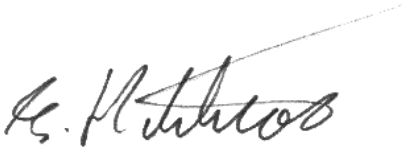

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Glossary

Abbreviation/phrase	Definition
BAU	Business as usual
CH_4	Methane
CO_2	Carbon dioxide
FHS	Future homes standard
N_2O	Nitrous oxide
Net zero	Defined as a 95% reduction in net carbon dioxide emissions by 2030
NZP	Net zero projections tool developed by Ricardo Energy & Environment
SCATTER	Setting City Area Targets and Trajectories for Emissions Reduction

1 Introduction and scope of analysis

Sheffield City Council has set a target for the city to be zero carbon by 2030. In addition, in their report of June 2019, the Tyndall Centre recommended that the city should stay within a cumulative CO_2 emissions budget of 16 Mt CO_2 for the period of 2020 to 2100, which would mean achieving near zero carbon emissions by no later than 2038. The City Council has commissioned ARUP and Ricardo to support them in developing a plan to achieve this net zero goal. The work being carried out falls into 4 work packages:

- WP1 Baseline inventory – developing a detailed understanding of current carbon and GHG emissions;
- WP2 Gap Analysis – projecting this baseline inventory forward under business as usual to assess the scale of the challenge required to meet net zero emissions;
- WP3:
    - WP3.1 City level mitigation pathway – developing a set of mitigation options at the city level that can achieve the net zero goal;
    - WP3.2 Council estate mitigation pathway – developing a set of detailed mitigation actions for the councils own buildings and fleet;
- WP4 Governance arrangements – will develop the governance approach to support delivery of the net zero pathway.

This report sets out the results of WP2 where the baseline CO_2 emissions inventory provided in WP1 is projected to 2037 under 'business as usual' (BAU) conditions.

1.1 Scope of analysis

The purpose of WP2 was to take the baseline inventory data for Sheffield from WP1 and project this forward to 2037 under a business as usual (BAU) scenario. BAU is defined as a continuation of existing trends and policies and is therefore used to inform what is likely to happen to future emissions if those trends and policies were to continue. Doing this can then allow for an assessment of the size of the gap to any emissions targets, and is the starting point to then consider what would need to be done to meet those targets.

'BAU' in this report is defined as a scenario where current and expected UK Government policies, including all expired, implemented, adopted and planned policies are implemented and projected into the future for existing fuels and sectors based on demand growth and energy efficiency improvements. This follows guidance from the UN Framework Convention on Climate Change (UNFCCC) on BAU emissions scenarios.

As mentioned briefly in Section 1 above, when carrying out this gap analysis there are two targets against which emissions should be assessed – the 2030 target set by Sheffield City Council for the city to become zero carbon, and the emissions pathway proposed by the Tyndall Centre from an analysis of Sheffield's 'appropriate share' of global efforts to reduce GHG emissions under the Paris Agreement. We now look at each of these in turn.

1.1.1 Sheffield's zero carbon target

In 2019, Sheffield City Council declared a climate emergency and stated its intention to work towards Sheffield becoming a zero-carbon city by the end of this decade, and playing its full part in the Paris Agreement[1].

There are different ways to define carbon targets, for example:

[1] Agreed in 2015, the Paris Agreement has been signed up to by 195 countries and sets a target of limiting global temperature rises to below 2 degrees centigrade above pre-industrial levels, and aiming for 1.5 degrees. The Paris Agreement can be found here - https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf

- Whether the target is absolute zero emissions or net zero emissions (accounting for offsets).
- Whether the target (absolute or net) needs to be zero or near zero, as many analyses assume it will not be possible to get to complete zero.
- Whether the target relates just to carbon dioxide or all GHGs.

It was agreed with the client that for the purposes of this analysis, Sheffield's zero carbon ambition would be defined as follows – net zero carbon dioxide, defined as a 95% reduction in net emissions. This follows the approach used by the Tyndall Centre in their analysis (see below), where they only considered energy-related CO_2 emissions (and not other GHGs such as CH_4 or N_2O) and used the 95% definition. This approach makes sense as CO_2 is the dominant GHG, as shown clearly in the WP1 analysis (see Section 1.2) but at the same time it recognises the inherent challenge in reducing net CO_2 emissions to zero in such a short timescale, and the likelihood that, as noted by the Tyndall Centre, the CO_2 emissions reduction pathway is likely to fall rapidly in initial years but then more slowly in later years to reach a plateau.

1.1.2 Tyndall Centre carbon budget

The Tyndall Centre has carried out analysis that takes the Paris Agreement temperature goals outlined above, turns them into a global carbon budget, allocates that global budget between countries and then allocates the UK's share between local authorities. This therefore shows what each local authority should do in terms of reducing CO_2 emissions to be giving their fair contribution under the Paris Agreement.

The Tyndall Centre carried out this analysis in 2019, and proposed a 16 Mt CO_2 carbon budget for the period 2020-2100. This equated to meeting near zero CO_2 emissions (defined as a 95% reduction) by 2038. This analysis was subsequently updated more recently, with some changes to the assumptions used to calculate the carbon budgets, and this resulted in revised figures – a 15.2 Mt CO_2 for the period 2020-2100, or 19.6 Mt CO_2 for the period 2018-2100 (i.e. adding in emissions from 2018 and 2019) (Table 1). This equated to meeting near zero carbon emissions by 2043. The full report can be found at the Tyndall Centre website[2].

Table 1 Tyndall Centre recommended carbon budgets for Sheffield

Carbon budget period	Recommended carbon budget (Mt CO_2)
2018-2022	9.3
2023-2027	4.9
2028-2032	2.6
2033-2037	1.3
2038-2042	0.7
2043-2047	0.4
2048-2100	0.4

Hence the BAU pathway that would be produced in WP2 would be compared both against the 2030 target and the updated Tyndall Centre carbon budget of 19.6 Mt CO_2 from 2020-2100.

[2] https://carbonbudget.manchester.ac.uk/reports/E08000019/print/

1.2 WP1 summary – baseline inventory data

The starting point for the BAU analysis in WP2 was the emissions data produced in WP1. WP1 provides a 2005-2017 baseline inventory for Sheffield City Council, where local and regional carbon dioxide (CO_2) emissions estimates for the UK (LA CO_2)[3] were spatially disaggregated for:

- Industrial and Commercial Gas, Electricity and 'Other fuels[4]'
- Large Industrial Installations[5]
- Domestic Gas, Electricity and 'Other fuels[4]'
- Road Transport (A roads, motorways, minor roads)
- Agriculture, Waste and Land Use

Industry and commercial emissions comprise 35% of Sheffield's emissions, and domestic emissions 33%. These sectors have the largest proportion of emissions and are almost entirely CO_2. Transport is the 3rd largest sector at 26% of emissions and again almost entirely CO_2 (Figure 1). The remainder are from agricultural, waste and land-use, which form most of the non-CO_2 GHG emissions. All sectors have seen declining emissions with the industrial and commercial sector reducing the most followed by the domestic sector. The transport sector has seen the least reduction at only ~17% since 2005. WP1 shows that 90% of total GHG emissions in Sheffield are CO_2 hence the focus for WP2 (Figure 1).

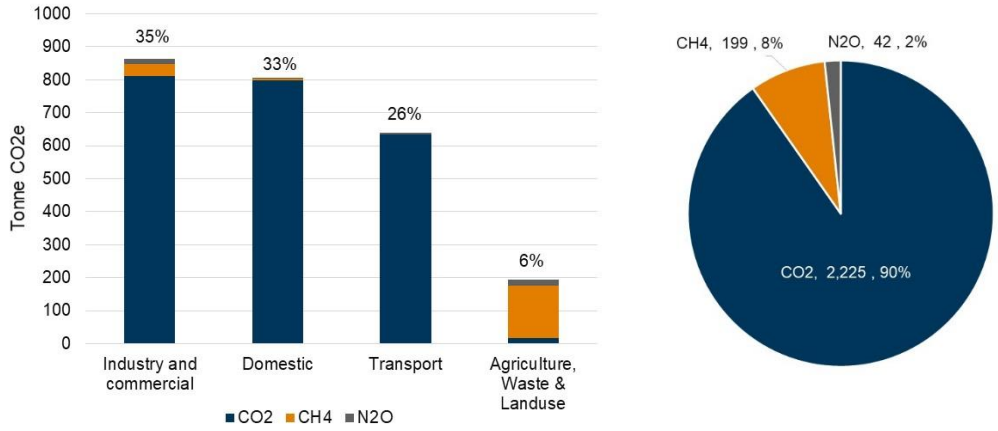

Figure 1: Breakdown of greenhouse gas breakdown by sector (kt CO_2e) and by gas in Sheffield for 2017

[3] Produced by Ricardo Energy & Environment for the Department of Business, Energy & Industrial Strategy (BEIS).

[4] 'Other fuels': equates to petroleum, coal and manufactured solid fuels.

[5] Pulp, paper and print combustion, electric arc furnaces, food, drink and tobacco combustion, iron and steel combustion plant, public sector combustion, other industrial combustion, non-ferrous metal combustion and industrial urea use.

When focusing on CO_2 only, total emissions in Sheffield have dropped by 42% between 2005 and 2017. On a sector level, this breaks down to a 55% reduction in industrial and commercial CO_2 emissions, a 37% reduction in domestic CO_2 emissions and a 13% reduction in CO_2 emissions from transport (Figure 2).

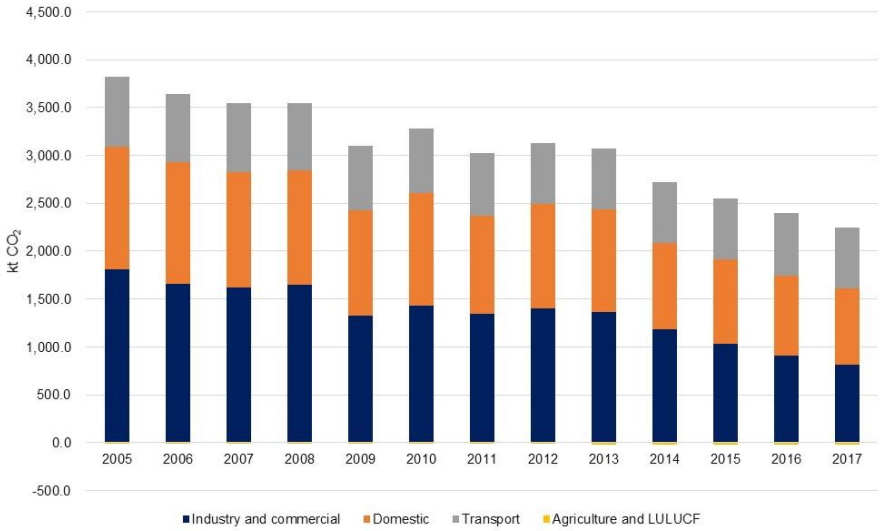

Figure 2: Time series of CO_2 emissions by sector in Sheffield (kt CO_2)[6]

[6] Note that LULUCF is a net sink in most years, so appears below the x-axis.

2 Methodology

2.1 Base year extrapolation

Since the delivery of Work Package 1, an update of the BEIS Local Authority (LA) CO_2 emissions was published, which provides CO_2 emissions for each LA from 2005 to 2018. To understand a simplified projection of Sheffield's CO_2 emissions, this dataset for Sheffield was extrapolated from 2005-2018 into the future to see when Sheffield might reach net zero emissions (Figure 3). This illustrated that Sheffield has already made good progress, but this progress is variable between sectors.

When analysing emissions projections for each sector, it becomes clear that emissions from Transport have shown the lowest rate of decline since 2005 and might therefore take longest to reach zero carbon. In fact in this extrapolation exercise, Transport emissions did not reach net zero until around 2095 (Figure 4). Industry and commercial emissions have shown the greatest rate of decline since 2005, and reach net zero by 2030 when extrapolated. However, this takes into account past trends, for example reductions in gas and electricity consumption, the economic recession, and closures in large industrial installations which would not be applicable to future trends in emissions (Turtle et al., 2020).

These extrapolations are based only on historical trends rather than future policies and assumptions, hence are not realistic BAU pathways. The emissions reductions seen so far are likely to have come from measures which could be considered 'low hanging fruit' – easier and cheaper measures, including ones that save money. Looking ahead, more challenging and costly measures will likely be needed, meaning we would not necessarily expect the same level of emissions reductions without further policy intervention. Furthermore, the emissions reductions realised so far will have come predominantly from decarbonisation of the electricity grid. While likely to continue, the relative gains from this are likely to fall and there will be a need to focus on other measures focused on decarbonisation of heat and transport.

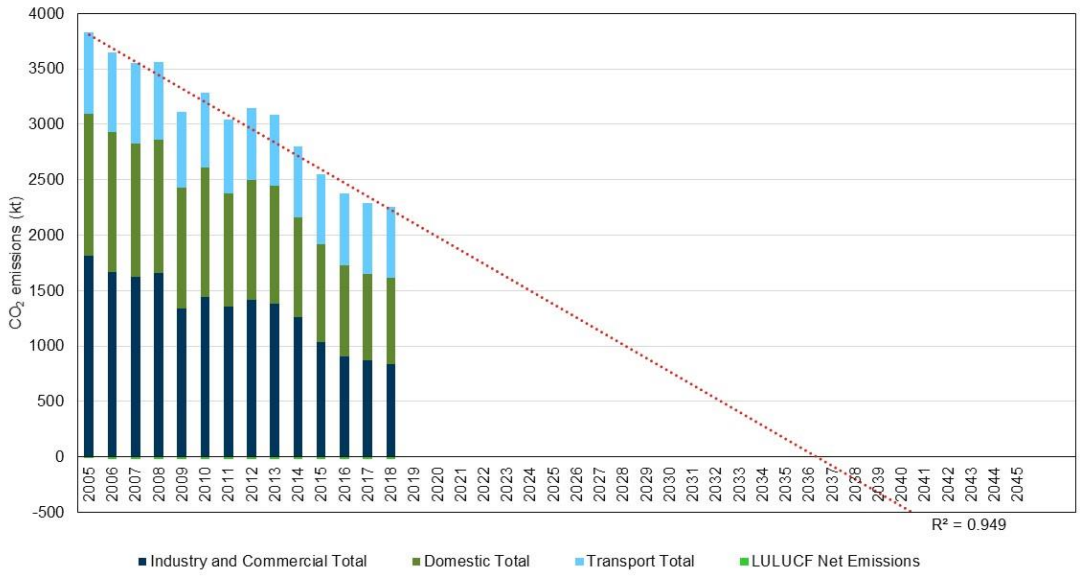

Figure 3: Extrapolation of the BEIS LA CO_2 2005-2018 dataset

Therefore, a more complex model was developed and used to project a more accurate BAU emissions pathway.

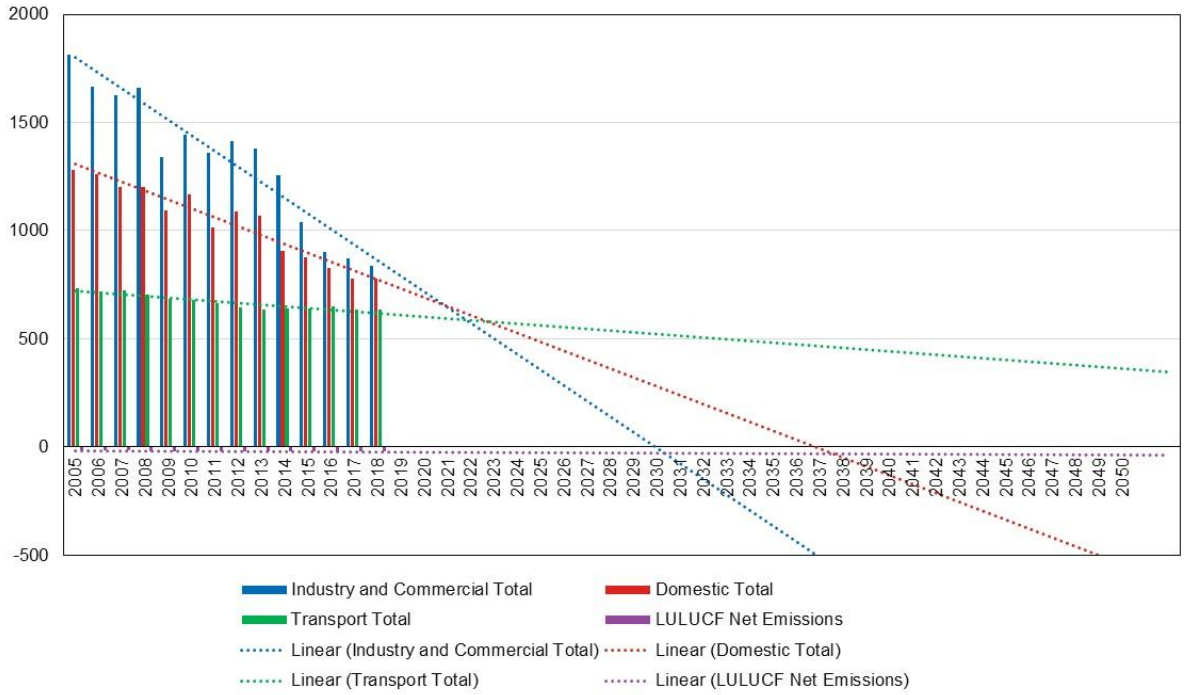

Figure 4: Extrapolation of the BEIS LA CO_2 2005-2018 dataset by sector

2.2 Defining a BAU scenario

To develop a BAU scenario, we used Ricardo's Net Zero Projection (NZP) tool (see Section 2.3 below). We aimed to do this by taking a two-step approach – first reviewing national-level emissions projections that take account of existing trends and policies, such as those from the Department of Business, Energy & Industrial Strategy (BEIS), the Department for Transport (DfT) and the Committee on Climate Change and then adding in the potential impact of local CO_2 reduction programmes and policies (Figure 5).

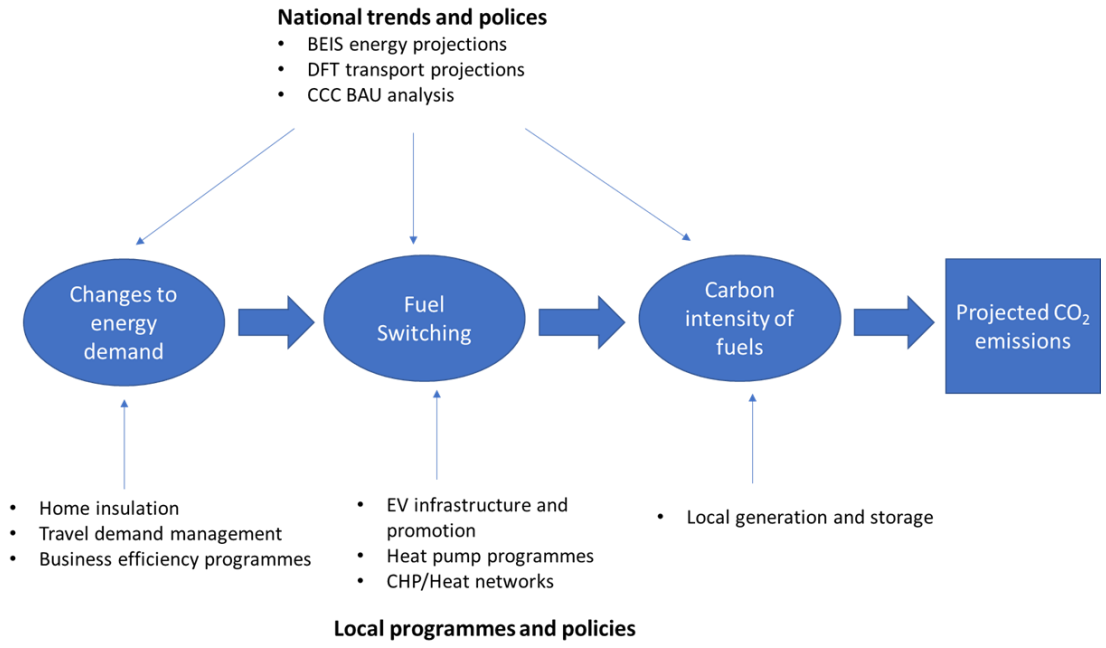

Figure 5: Process for developing projected CO_2 emissions in Sheffield

At the national level, Energy and emissions projections from the Department for Business, Energy & Industrial Strategy (BEIS) and Transport Projections from the Department for Transport (DfT) were used. These data sets provide a central reference case scenario for emissions based on projections of future demand for energy, and traffic respectively by year. The central reference case scenario for the BEIS energy projections is the main projection under current and expected UK Government policies, including all expired, implemented, adopted and planned policies. The emissions estimates are based on future energy demand by year, economic sector and fuel for electricity, natural gas, petroleum products and solid and manufacture fuels (e.g. coal) (BEIS 2019). Similarly, the DfT reference scenario uses central projections of GDP, fuel price and population and assumes that the number and type of trips per capita remains constant over time (DfT 2018).

By applying these reference scenarios to Sheffield's baseline inventory, we can see how CO_2 emissions will react to a BAU scenario, and the different sectors that Sheffield will have to focus on in the coming years to decrease emissions and reach their zero carbon target by 2030. The benefit of taking this approach, and using the BEIS projections of energy demand, is that these projections already take account of existing policies (see Section 2.4 for details on the policies that are included).

2.3 Ricardo Net Zero Projection (NZP) tool

The Net Zero Projection (NZP) tool enables users to model the impact of implementing mitigation measures on CO_2 emissions over time. The tool is designed to enable the development of scenarios for reaching net zero by a given target year, in this case 2037. The tool allows the user to project CO_2 emissions forward for existing fuels and sectors based on assumptions on demand growth and energy efficiency improvements (both %/yr), as well as a consideration of options for fuel switching, for example switching from petrol/diesel cars to electric vehicles, or from gas boilers in buildings to heat pumps.

A BAU scenario was used as a base line projection, and allows the assessment of the likely impact of planned measures. In addition, scenarios were also used to undertake sensitivity testing around the impact of changes in assumptions (see Section 3).

2.4 Assumptions

Having entered the forecasts of changes to energy consumption from BEIS into the NZP tool, we then checked what assumptions sit behind the BEIS forecasts and compared these to the equivalent values for Sheffield. If the values were significantly different, we would then consider making adjustments to the BAU scenario to account for this.

The main assumptions are outlined in Table 2 below.

Table 2 Model inputs to produce a BAU scenario for Sheffield

Assumption	UK-wide growth factor (BEIS)	Sheffield-specific growth factor
GDP growth	2.10 % pa	2.2 % pa
Households	0.85 % pa	0.50 % pa
Uptake of electric vehicles	25% of car and van mileage zero emissions by 2050	Not available
Traffic growth by 2035	1.01 %	0.97 %

It was felt that the values were sufficiently similar to not require a further adjustment to Sheffield's BAU scenario. A few points should be noted, as data was not available in all cases at the Sheffield level:

- For GDP we were not able to find any forecasts for Sheffield. However we used historical data for the South Yorkshire region (available on BEIS website) and used the data from recent years (2012-18) to derive the 2.2% a year value.
- Traffic growth forecasts were used for the Yorks and Humber rather than Sheffield, as provided by DfT (2018).

In terms of policies, the BEIS projections of energy consumption already take account of existing policy measures, as at April 2019 (when the latest forecasts were published). For example they take account of the Renewable Heat Incentive and Buildings Regulations Part L for the domestic, commercial and industry sectors, and for car, van and truck fuel efficiency policies in the transport sector. For a full list of the policies that are included in the BEIS projections, see Appendix A1. As outlined in Section 3 below, to this we added any further policies that have been developed or implemented since the publication of the last BEIS energy and emissions projections.

We then reviewed policies that are specific to Sheffield, to consider whether any of these will have an impact on emissions in the BAU scenario above and beyond the impact of the national-level policies outlined in Appendix A1. The list of local policies that were considered are included in Appendix A2, along with a consideration of whether they would have additional impact. From this, we took the view that none of them are likely to reduce CO_2 emissions additionally to the assumptions already set out in the BEIS energy and emissions projections. The

3 Projections

3.1 Central Sheffield BAU scenario

Figure 6 presents the final outcome of WP2: a central BAU scenario for Sheffield. This was derived by combining inputs from the scenarios that follow in Sections 3.2 to 3.5. This includes:

- BAU scenario – incorporates existing UK policies, and energy and emissions projections from BEIS and transport projections from DfT.
- COVID-19 scenario – where GDP falls by 25% between February and April 2020 and then starts to recover.
- The Future Homes Standard.
- A ban on sales of new petrol and diesel cars and vans.

This results in a reduction in CO_2 emissions from 2017 levels of 23.4% reduction by 2030 and 34.7% by 2037. However, even with these significant reductions in emissions, the Tyndall Centre carbon budget for 2018-2027 would be used up by 2025 and Sheffield does not get close to reaching net zero even by 2050.

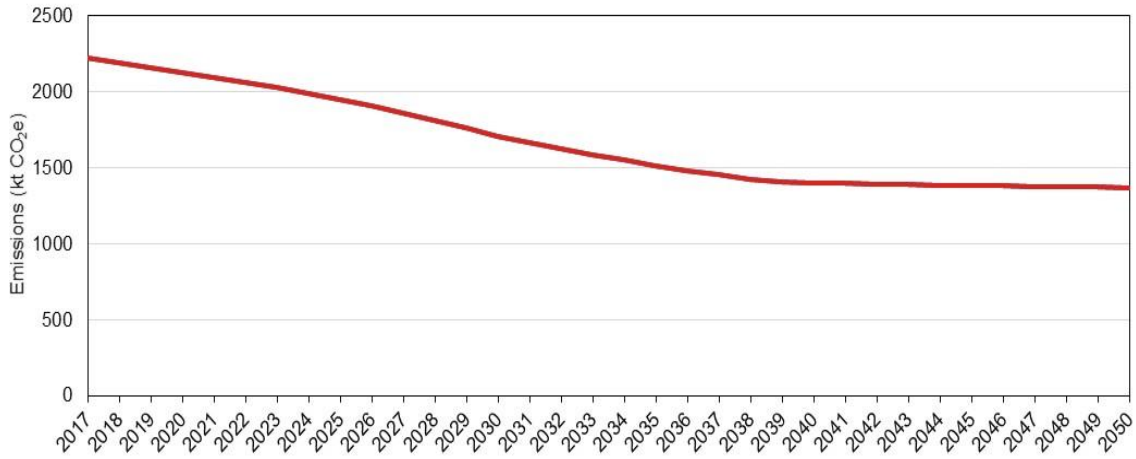

Figure 6 Total CO_2 emissions projection to 2050 for Sheffield under the central Sheffield BAU scenario

3.2 BAU scenario

This scenario was the first scenario developed using the NZP tool, and the scenario in which emissions decrease by the least by 2030 and 2037. Figure 7 illustrates the BAU scenario developed using the assumptions provided in Section 2.4 for all sectors. Here, CO_2 emissions decline by 16.9% by 2030, and 24.1% by 2037 and do not come close to net zero by 2050.

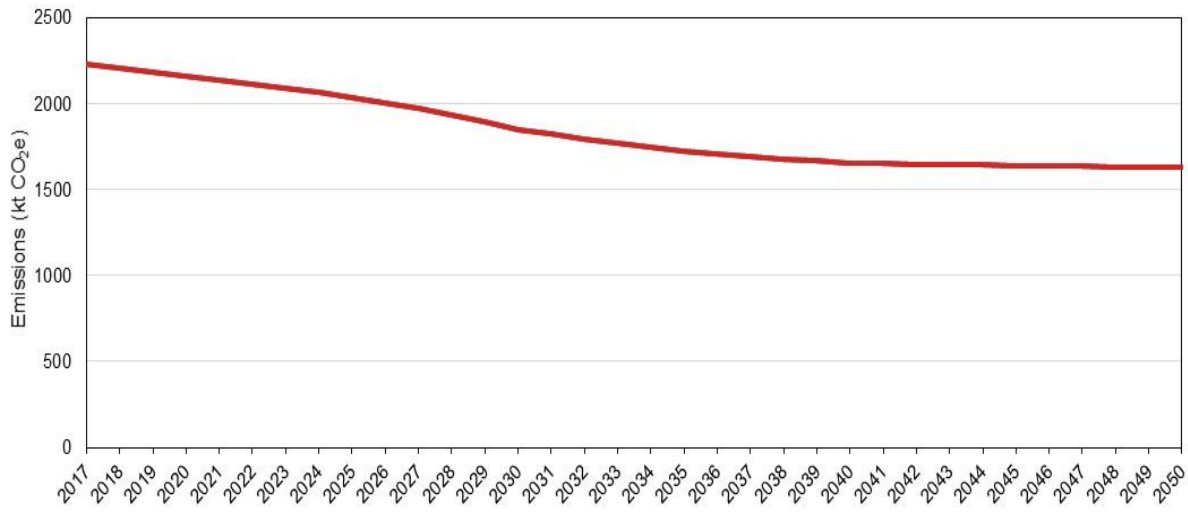

Figure 7 Total CO_2 emissions projection to 2050 for Sheffield under a BAU scenario

As a comparison, an equivalent BAU scenario for Sheffield was produced using the Setting City Area Targets and Trajectories for Emissions Reduction (SCATTER) tool[7] which shows a similar pathway to that from the NZP tool when level 1 is selected for all interventions, which is broadly equivalent to a BAU scenario (Figure 8).

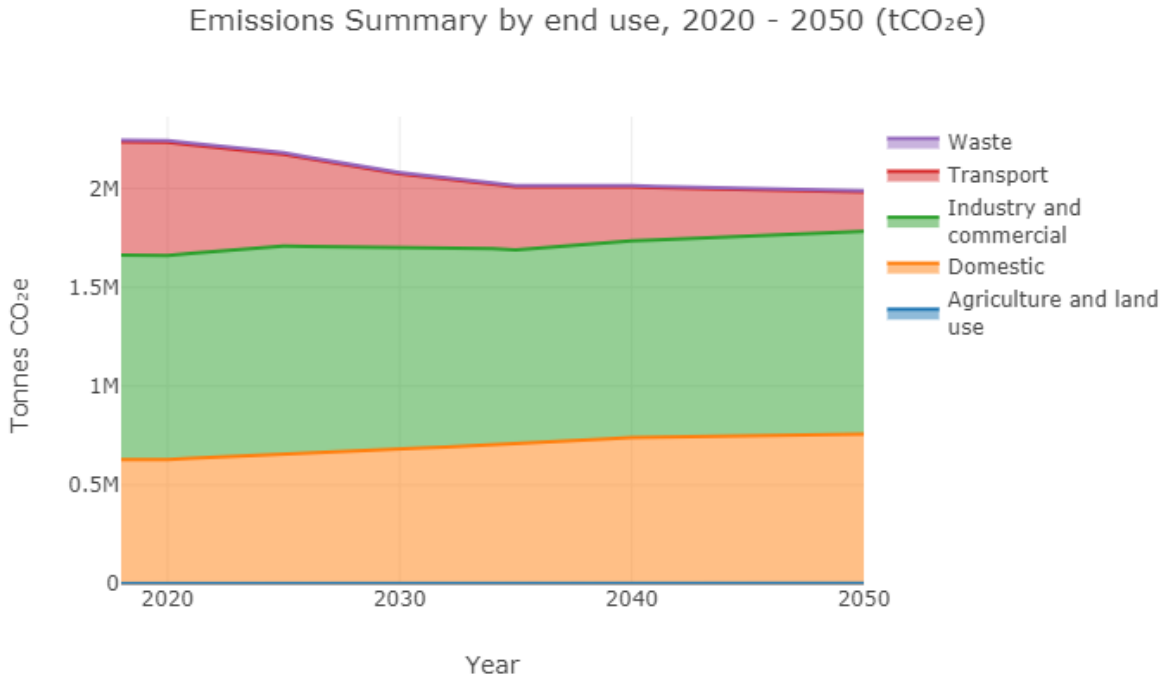

Figure 8 BAU scenario from 2020 to 2050 using the SCATTER tool

3.3 COVID-19 scenario

To create a more realistic BAU scenario with current uncertainty of the UK economy, a COVID-19 scenario for Sheffield was created. According to model results from the Office for Budget

[7] https://scattercities.com/

Responsibility (OBR) Fiscal sustainability report in 2020, GDP fell by 25% between February and April and is now recovering. Their central scenario equates to a 12.4% reduction in GDP in 2020 with GDP down 3% in the long run.

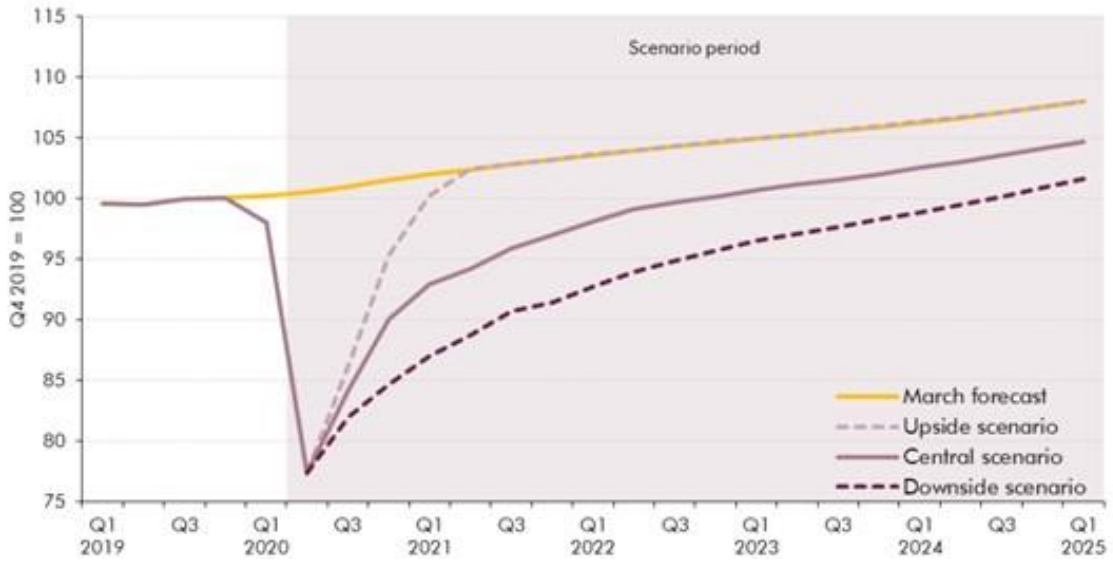

Figure 9 OBR real GDP versus March forecast (OBR 2020)

By taking Figure 9 into account, we calculated the ratio of overall energy demand to GVA growth for each sector, then re-scaled the BEIS growth factors to the different economic growth rates. Results from this can be seen below in Figure 10. In comparison to the initial BAU scenario outlined in Section 3.2, CO_2 emissions for Sheffield are 2.7% lower by 2030 and 4.2% lower by 2037. This means a 19.6% reduction by 2030 and 28.3% reduction by 2037. However again, emissions do not get close to net zero even by 2050.

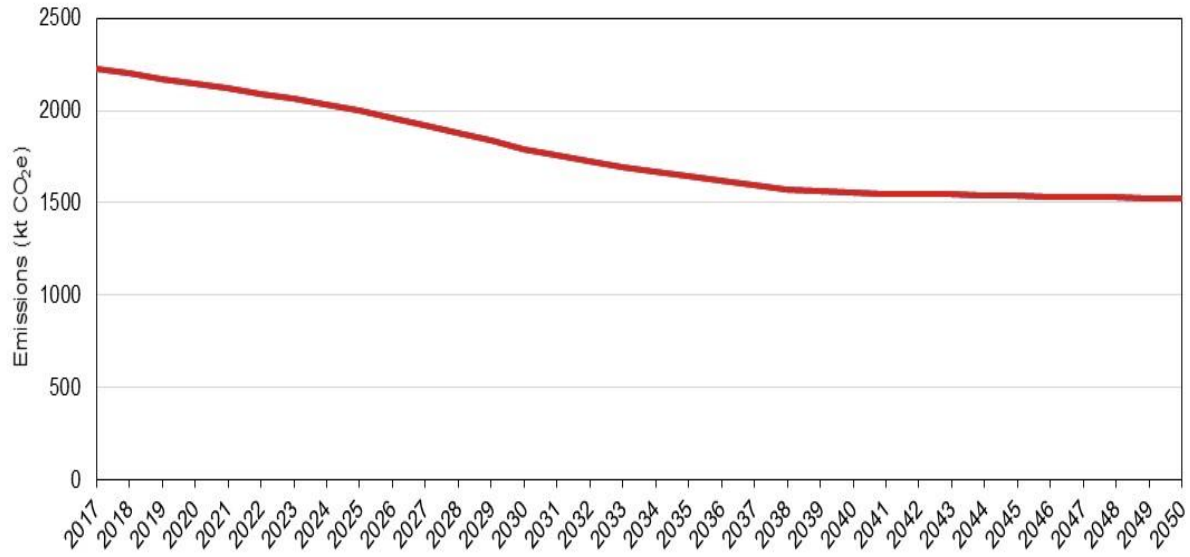

Figure 10 Total CO_2 emissions projection to 2050 for Sheffield under a COVID scenario

3.4 The Future Homes Standard

Another measure that was taken into account was the Future Homes Standard (FHS)[8]. This policy is not taken into account in the BEIS energy and emissions forecasts, hence another scenario was modelled using the NZP tool. The FHS will require an increase in energy efficiency requirements for new homes in 2020, and new build homes to have low carbon heating – to be introduced by 2025.

Under this scenario, the pathway looks very similar to the original BAU projection and COVID-19 scenario. With the FHS in place, emissions decline by 2.1% and 3.3% more than the 2030 and 2037 BAU scenario respectively. This equates to a 19.0% reduction in CO_2 by 2030 and 27.4% by 2037. As most new homes have already been built in Sheffield with the FHS, the policy does not have a notable impact over the time series.

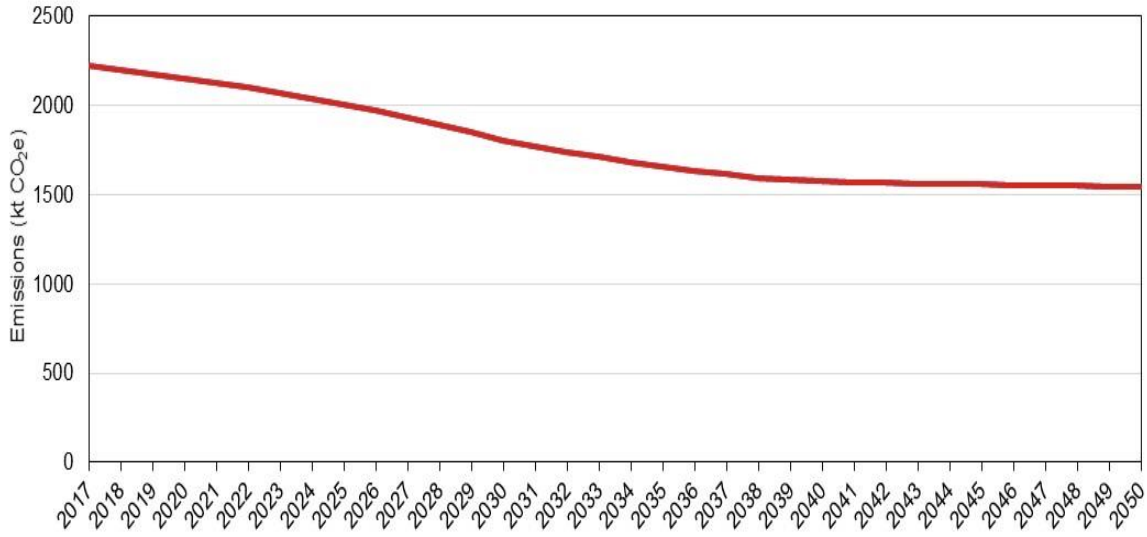

Figure 11 Total CO_2 emissions projection to 2050 for Sheffield under the Future Homes Standard (FHS)

3.5 Ban on new sales of petrol and diesel cars and vans

To incorporate another future policy that is not currently accounted for in the DfT traffic forecasts, a scenario was created to implement a ban on new sales of petrol and diesel cars and vans by 2032. Existing Government policy is that this ban would take effect by 2040, but the Governemnt is currently considering bringing this forward to at least 2035 or possible earlier (e.g. 2032).

Out of all scenarios other than the central Sheffield BAU, this scenario has the biggest impact on CO_2 emissions. In Figure 12, there is a 22% reduction in CO_2 emissions between 2017 and 2030, and a 33.3% decline in emissions between 2017 and 2037. This relatively big impact is to be expected, as it would affect sales of all new vehicles, and bringing the date forward by 8 years would have a significant impact on the average efficiency of the existing UK car parc (i.e. all vehicles on the road, rather than just new vehicles).

[8] https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings

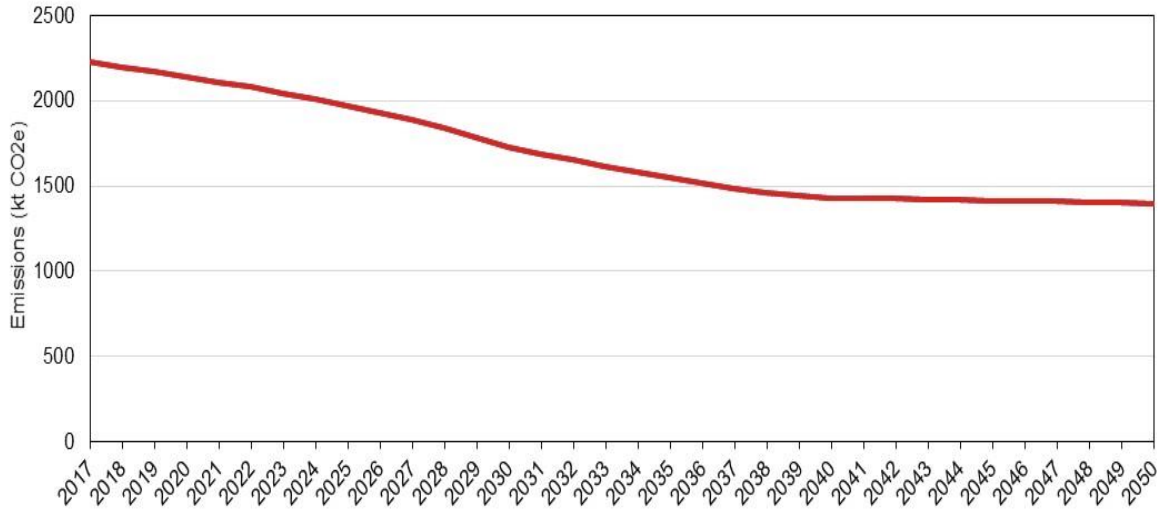

Figure 12 Total CO_2 emissions projection to 2050 for Sheffield under a ban on new sales of petrol and diesel cars and vans by 2032

In Table 3 below, a summary of all model outputs is provided. The details of steps taken to model the additional scenario (COVID-19, FHS and car and van phase out) is provided in Appendix 3.

Table 3 Summary of model outputs from the NZP tool

Scenario	Description	CO_2 reduction 2017-2030 (%)	CO_2 reduction 2017-2037 (%)
Central BAU	BEIS reference, plus impacts of COVID-19, FHS and car/van phase out	23.4	34.7
Basic BAU	Latest (2019) BEIS and DfT projections, central forecast	16.9	24.1
COVID-19	Taking account of COVID-19 OBR forecasts	19.6	28.3
FHS	Taking account of Future Homes Standard	19.0	27.4
Car and van phase out	Phasing out sales of new petrol/diesel cars and vans by 2032	22.2	33.3

4 Conclusions and observations

Overall, Sheffield has already made some good progress in reducing emissions between 2005 and 2017, with the rate of emissions reductions being higher than the national average so far. This report has highlighted that the current policy landscape is not sufficient to meet net zero by 2030, or even to continue this level of emissions reductions into the future. This reflects the picture at the national level, where the current policy landscape is not sufficient to meet the fourth and fifth carbon budgets (**Error! Reference source not found.**), nor net zero by 2050. This is consistent with other sources, such as the projections produced using the SCATTER tool.

Table 4 Comparison between Tyndall Centre recommended carbon budgets for Sheffield, and Central BAU NZP tool output

Carbon budget period	Carbon budget (Mt CO_2)	Central BAU scenario (Mt CO_2)
2018-2022	9.3	10.65
2023-2027	4.9	9.75
2028-2032	2.6	8.57
2033-2037	1.3	7.59
Total	18.1	36.56

Much of the progress in reducing CO_2 emissions in recent years has been from grid decarbonisation, which has progressed at a rapid pace. The additional gains from this are lower than previously anticipated, and more focus will need to be turned to tricky areas such as decarbonisation of heat and transport.

In terms of the 'emissions gap', it can be seen from the table above that the gap between actual emissions and the Tyndall Centre carbon budgets grows over time such that by the end of the 2033-37 carbon budget period, Sheffield will cumulatively be over 18 Mt CO_2e over the carbon budget for the period 2018-37.

To reach zero carbon emissions, defined as a 95% reduction in net CO_2 emissions by 2030, CO_2 emissions in Sheffield would have to reduce from 2.23 Mt CO_2e in 2017 to 0.11 Mt CO_2e in 2030. According to our Central BAU scenario, in 2030, CO_2 emissions will be 1.71 Mt CO_2e, which is 1.6 Mt CO_2e higher than the zero carbon target as defined in this project.

Whilst expected forthcoming policy announcements from the UK Government will have an impact and help in reducing emissions, it will still not be enough to ensure that Sheffield reaches net zero within a suitable time frame.

The next steps of this project will be WP3, where we will consider mitigation options to provide guidance to Sheffield City Council on how to reach net zero emissions and close the current gap that exists in doing so.

- WP3.1 City level mitigation pathway – developing a set of mitigation options at the city level that can achieve the net zero goal;
- WP3.2 Council estate mitigation pathway – developing a set of detailed mitigation actions for the councils own buildings and fleet;

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Appendices

These appendices contain additional information that supplements the main chapters.

A1 Policy assumptions for a BAU scenario

Table A1.1 Policy assumptions made to project a BAU scenario for Sheffield

Domestic	Commercial	Industry	Transport
Building regs Part L	Building regs Part L	Building regs Part L	Renewable Transport Fuel Obligation (RTFO)
Products policy	Products policy	Products policy	Car fuel efficiency policies
Smart metering	Smart metering	CRC-ees	LGV fuel efficiency policies
Heat Networks Investment Project	Heat Networks Investment Project	ESOS	HGV fuel efficiency policies
Renewable Heat Incentive	Renewable Heat Incentive	Renewable Heat Incentive	Local sustainable transport fund
Private Rented Sector (PRS) Energy Efficiency Regulations	PRS Energy Efficiency Regulations	PRS Energy Efficiency Regulations	PSV fuel efficiency policies
F-gas regulation	F-gas regulation	F-gas regulation	SECR
Boiler Plus	Energy Performance of Buildings Directive (EPBD)	Industrial Heat Recovery Support (IHRS)	
Energy Company Obligation	CRC-ees	CRC-ees	
	ESOS	ESOS	
	Streamlined energy and carbon reporting framework for business (SECR)	SECR	

Source: adapted from Annex D of the BEIS updated energy and emissions projections 2018 (https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2018)

A2 Local policies

Table A2.1 Sheffield local policy review

Document	Policy/strategy name	Target	Impact category	Comments
Sheffield Development Framework Core Strategy, Adopted March 2009	CS 22 – Scale of the Requirement for New Housing	Trajectory targets from Fig 8.1 achieved in each year in the period 2004 to 2026. 1,425 net requirement per year for dwellings 2020/21 to 2025/26	Housing	To be included in projections
Sheffield Development Framework Core Strategy, Adopted March 2009	CS 64 – Climate Changes, Resources and Sustainable Design of Developments	All developments over the size thresholds in the period to 2026 to achieve the required standards of sustainability (Code for Sustainable Homes Level 3 for residential developments or BREEAM very good for non-residential developments)	Buildings	Not included in projections as standards do not effectively drive a reduction in emissions
Sheffield Development Framework Core Strategy, Adopted March 2009	CS 65 – Renewable Energy and Carbon Reduction	12MW of renewable energy capacity provided by 2010 and 60MW by 2021	Energy	Not included in projections as should have already been achieved
Sheffield City Region Transport Strategy	-	By 2040, Increase trips by 18% bus, 100% rail , 47% tram, 21% walking and 350% cycling and manage the increase in private car/van/goods trips to 8%. Reduce tailpipe carbon emissions in line with targets for the UK and have a zero carbon public transport network by 2040.	Transport	Not included in projections as in line with national policy
Sheffield Transport Strategy, March 2019	-	We will intervene to enable shift away from carbon intensive modes of transport to less carbon intensive modes where these are suitable. We will aim to achieve a zero carbon public transport network. We will improve our offer for walking, for cycling and for public transport, to ensure improved access to jobs and skills is not limited to those who have access to a car.	Transport	Not included in projections as in line with national policy
SCR Municipal Waste Strategy 2016-2021	Strategic Priority 1 - Educate and Inspire	Increase recycling by 10kg per household by 2021. Reduce household waste by 2kg per household each year – year on year until 2021. Deliver a targeted reduce, re-use, recycle campaign to at least 100,000 households across South Yorkshire each year, by 2021	Waste	Not included in projections as waste won't be modelled as it's a minor point.

Document	Policy/strategy name	Target	Impact category	Comments
Green City Strategy	-	By 2025, The Council and its partners will have increased the level of low carbon and renewable energy generation in the city. By 2030 A significant level of the city's energy will be supplied, from locally generated low carbon and renewable technologies. We will develop an approach to decarbonise our existing heat networks, exploring further approaches to decarbonise domestic heating across the city.	Energy	Not included in projections as no clear policy or target that impacts on carbon
Green City Strategy	-	New homes built in the city will be very low or zero carbon – Our Local Plan includes policies which promote the development of low carbon homes; constructed to high standards of energy efficiency, which will generate their own heat or power. These homes will use significantly less energy and as a result have lower running costs for residents, as well as reducing the city's overall carbon emissions. Our council home building programmes will create very low or zero carbon, energy efficient homes. Where funding allows homes will also generate their own heat or power.	Housing	Not included in projections as no clear policy or target that impacts on carbon
Green City Strategy	-	Buses - work in partnership with the bus companies to improve the bus fleet and reduce emissions through replacement low-emission buses or retrofitting vehicles with cleaner engine technology. Cars - consider specific schemes to support people on lower incomes to change to lower emission vehicles, particularly where their job or responsibilities require unavoidable and frequent use. Freight/HGVs - support the Eco Stars scheme, which helps commercial vehicle operators to reduce their emissions; promote the use of lower emission vehicles across our fleet. Promoting clean travel - encourage more walking, cycling and active commuting in the city.	Transport	Not included in projections as no clear policy or target that impacts on carbon
Sheffield City Region Integrated Infrastructure Plan	Housing increase by Growth Area and Urban Centre: 2014 - 2024	12,469 new homes in Sheffield City Centre 2014 – 2024. 19,627 new homes in Sheffield Local Authority 2014 - 2024	Housing	Using CS22 in projections as takes into account net homes
Sheffield City Region Integrated Infrastructure Plan	Renewable energy capacity	Planned schemes account for 276MW planned renewable energy capacity. 1no. advanced conversion technologies, 2no. Anaerobic digestion, 5no. Biomass, 1no. EFW incineration, 18no. Solar photovoltaics, 5no. Wind onshore.	Energy	Not included in projections as impacts on carbon are not clear
Our City Centre Plan 2018-28	3 City Centre and the economy	Currently 277,600 jobs in Sheffield City centre (2018), forecasting an additional 20,500 jobs until 2024.	Buildings	Not included in projections as impacts on carbon are not clear
Our City Centre Plan 2018-28	Street lighting	Replace all street lighting with low energy (LED), smart, directional street lighting as part of the Streets Ahead programme by 2020	Buildings	Not included in projections as assuming initiative has been completed

Document	Policy/strategy name	Target	Impact category	Comments
Housing Strategy 2013-2023	-	-	-	Not included in projections as no clear policy or target that impacts on carbon
New Homes Delivery Plan 2018-2023	-	-	-	Using CS22 in projections as takes into account net homes
Lower Don Valley Masterplan Study	-	-	-	Not included in projections as no clear policy or target that impacts on carbon
SCR Active Travel Implementation Plan	-	-	-	Not included in projections as no clear policy or target that impacts on carbon
SCR Integrated Rail Plan	-	-	-	Not included in projections as no clear policy or target that impacts on carbon
Sheffield Parking Strategy	-	-	-	Not included in projections as no clear policy or target that impacts on carbon
SCR Strategic Economic Plan	-	-	-	Not included in projections as no clear policy or target that impacts on carbon
Housing Infrastructure Fund	-	-	-	Not included in projections as no clear policy or target that impacts on carbon

A3 Modelling steps of COVID-19, FHS and diesel & petrol car phase out

Covid-19

1. Starting with BEIS's Unified Energy & Emissions Projects (UEP), reference scenario
2. Calculate the growth in GDP modelled under the low and high growth projections (GDP index=100 in 2005)
3. Subtract the low growth from the high growth projections, and derive the % change in each line in the energy projection per unit change in GDP.
4. Use the Bank of England's July 2020 forecast change in GDP growth due to Covid-19 to modify the GDP growth index for the reference scenario
5. Use the % change per unit change in GDP (step 3) to produce a customised energy projection under the GDP growth index (step 4).

Future Home Standard

1. Derive a projection of new home completions based on ONS Table 401: Household projections, United Kingdom, 1961-2039
2. Use the Future Homes Standard 2019 Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings: Impact Assessment to derive the number of FHS homes built per year over a 10 year period, and use stated assumptions for option 2 to back calculate the carbon savings to energy savings per year per home.
3. Extrapolate impact of FHS to 2038, and derive reduction in Domestic Gas and Electricity consumption due to introduction of Future Home Standard.

Diesel & Petrol Car & Van Ban Phase out

1. Use DfT Table ENV0101 (TSGB0301) : Petroleum consumption by transport mode and fuel type: United Kingdom, 1990-2018 to the proportion of the UEP forecast of petrol and diesel transport fuel use attributable to cars and vans.
2. Calculate the reduction in diesel and petrol use that will result of sales of new diesel and petrol cars and vans being banned from 2032, assuming 10% retirement of existing stock of cars & light vans per year. The 10% is based on an assumption that the average age of cars & vans on the road will reach c. 10 years by 2032 after examining trends in average age of vehicles VEH0211/VEH0411 (8.3 year) – and allowing for reduced scrappage rate - that is expected to occur in 2nd hand market.

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