

Appendix 3. Climate Emergency Action Plan – Carbon Assessment Methodology and Assumptions

Carbon Emissions Trajectory

Carbon emissions trajectories for the future are best estimates as it is impossible to make exact predictions. They are therefore based on the best available data from past emissions figures¹ and government projections. While it is impossible to be exact, these figures provide the best, most accurate reference for carbon accounting going forward. As explained in full in the CEAP methodology, these figures are all based on scope 1 and 2 emissions, while national statistics cover all aspects, including what would fall under scope 3 for us as a borough, such as motorways, diesel rail, aviation, industrial shipping and consumer purchases, amongst others. Therefore, national BEIS figures and their projections² may be slightly different to the expectations listed here.

Specifically, the business as usual (BAU) projection is based on the BEIS data covering the period between 2012 and 2017, as this is the most relevant and consistent data to represent potential future outcomes. In this period there was an average decline of 5.6% per year, which is the figure which has been used for extrapolation for future years. With the UK government's pledge to become net zero by 2050, alongside the introduction of multiple new commitments during 2020 (as outlined in full in the CEAP) that will significantly impact the future carbon emissions trajectory, this estimate remains realistic.

The government is continually reviewing policies and is likely to make additional changes, which will also be incorporated into our carbon accounting methodology and projections once they are realised. The carbon emissions BAU trajectory is expected to change year by year, as it will be impacted by new government policies, and national and global events (e.g. COVID-19 pandemic), therefore this should be used as a reference rather than an absolute figure.

For example, the proven effectiveness of working from for many companies during the pandemic in 2020 is expected to continue and provide a large decrease in emissions from commuting. However, this remains a live document which we review and will update as required, alongside BEIS updates which are released annually but backdated 2 years.

Meanwhile, the target emissions projection is based on experimental statistics because of inherent uncertainties in the estimation of CO₂ emissions. We used available tools to local authorities such as the Scatter Tool to build scenarios that help to understand the uncertainties and key elements that will affect emissions in the future. These scenarios demonstrate the level/type of changes which would be required in order to reach net zero, showing the estimated trajectories based on different parameters such as varying car use, electricity generation etc. Therefore, it has been calculated in reverse, finding out what level of reductions are needed to reach our 2030 goal, again being more front-loaded in terms of total reductions, to match government expectations. The differences here are then used to inform the targets, demonstrating their importance in reaching the overall 2030 goal.

¹ [2005 – 2019 UK Local & Regional CO₂ Emissions, BEIS June 2021](#)

² [Energy and Emissions Projections 2019](#), BEIS October 2020

Transport

Within this section, it is impossible to attribute the overall carbon savings directly to each action as many actions overlap or combine, therefore the total savings shown in the table may be different to the sum of the individual parts because of this. Each of these are best estimates based on the data available at this time. Target 7.9 has been removed after being explored and deemed unviable, however there were no carbon savings associated with this yet so there is no effect on the total.

Target 1. - Deliver a greenway network of over 37 Km across the Borough by 2030 with the ambition to deliver 60 Km by 2036

Action 1.1 - Deliver a comprehensive and connective network of greenway routes to encourage active and sustainable transport modes

- On average, people in the UK cycle 3.3 miles per trip cycled.³
- On average people cycling do so for 17 trips a year. The table below shows the breakdown of purpose of these 17 trips.⁴
- Assuming an 18% increase in those cycling once a month or more from the resulting improved greenways network (30,240 people) the carbon calculations can be seen below assuming there has been a switch from driving to cycling. This 18% increase is in line with the 18% modal shift away from cars and vans, and is supported as viable from the figures from bikeability and love to ride schemes, currently running at approximately 4000 trained users each year.
- The 11 trips made for utility (not for leisure) were each assumed to be the nationally average cycled mileage of 3.3 miles.
- This figure was then multiplied by the carbon emissions per mile of average petrol car (0.29103x3.3) accounting for 0.960399 KgCO₂e.⁴
- This figure was then multiplied by an 18% (30,240) increase in residents cycling in the borough due to the planned green ways network to result 29.03 tCO₂e saved per year respectively. This would occur at the completion of the network in 2036.
- By 2030 we are expecting 62% completion of the total 60km of greenways. Therefore we will expect to be saving 62% of the 29.03 tCO₂e expected in 2036. **This equate to 17.99 tCO₂e savings per annum.**
- This is therefore included within the Target 4 savings, but illustrated here to outline the benefit it contributes towards such.

Trips taken per person per year

Purpose	Bicycle
Commuting	6
Business	1
Education / escort education	1
Shopping	2
Personal business	1

³ Cycling UK Cycle Statistics

⁴ Department for Transport National Travel Survey (2018)

Leisure ⁵	6
Other including just walk	0
All purposes	17

Target 2. - Double public transport use by 2030 from 2019 baseline

Double Bus Usage

- There were 2,800,000 bus passengers recorded for 2019 in Wokingham. The kilometres travel on local bus services accounted for 2,200,000 km/year. The average km per passenger per year is therefore 0.79 km.
- Buses emit 103.0 gCO₂ per passenger per km, multiplying this by the average km per passenger per year (0.79) equates to 81 gCO₂ emissions per passenger per year.
- The average petrol car emits 180.8 gCO₂ per km. Multiplying this by the average km per bus passenger per year (0.79) equates to 142.9 gCO₂ emissions per passenger per year.
- We are assuming residents are replacing a car journey with a bus journey for this action. Therefore, the new 2,800,000 bus passengers will have reduced their carbon emissions from a private vehicle (2,800,000 x 142.9 gCO₂), this equates to 400.01tCO₂ per year.
- Multiplying the emissions per bus passenger per year (81 gCO₂) by the number of bus passengers recorded for 2019 (2,800,000) equates to 226.8 tCO₂ per year.
- Therefore, the difference from switching from cars to bus for this many people would save (400.01-226.8)= **173.3 tCO₂e per annum.**

Double Train Usage

- Currently 18% of Wokingham Borough residents use the train once a week. This amounts to 29,700. A 100% increase, would therefore be an additional 29,700 residents.
- We are assuming residents are replacing a car journey with a train journey. The average distance driven in a car journey is 8.2miles according to Government statistics.
- An averaged sized petrol car emits 2.4kgCO₂ in one journey (8.2 x 0.29103). Multiply this by the number of residents calculate to 71.28tCO₂ avoided per week (2.4 x 29700).
- Multiplying this by 52 weeks equates to the annual emissions from this car travel (71.28 x 52) = **3706.56 tCO₂e per annum.**
- Next the emissions from the train travel were taken away from the potential car travel emissions.
- National rail trains emit 0.04kgCO₂ per passenger per km. For the purposes of this calculation an assumption has been made that the train journey would be the same distance as average journey driven, although in reality this is unlikely. (0.04 x 13.2km) This gives the sum of 0.54kgCO₂ per passenger.
- This figure has then been multiplied by the number of residents involved in the 100% target increase which equate to 16.04 tCO₂ ((0.54 x 29700)/1000).
- This was then multiplied by 52 to give annual emissions of 834.08 tCO₂ (16.04 x 52).

- Finally this figure was taken away from potential driving emissions to give potential annual carbon emission savings of 2872.48 tCO₂ (3706.56 – 834.08).
- However, emissions from national rail are out of scope when considering the borough's carbon footprint. So potential carbon savings are the initial figure of **3706.56 tCO₂ per annum**.
- These calculations assumes all the car journeys are undertaken within the borough.

The total savings in carbon emissions from doubling public transport use by 2030 will account to **3879.86 tCO₂e per annum** (173.3+3706.56).

Action 2.9 Part A - Deliver the Winnersh Triangle Parkway parking projects. This will increase the amount of parking capacity at Winnersh parkway station to achieve a 10% increase in the number of Wokingham Borough residents who use a train from Winnersh station at least once a week by March 2026.

- Currently 513,392 of Wokingham Borough residents use the station at Winnersh per year. This amounts to 9,873 people per week. A 10% increase, would therefore be a further 988 residents.
- We are assuming residents are replacing a car journey with a train journey. The average distance driven in a car journey is 8.2miles according to Government statistics.
- An averaged sized petrol car emits 2.4 kgCO₂e in one journey (as above). Multiply this by the number of residents calculate to 2.37 tCO₂e avoided per week (2.4 x 988).
- Multiplying this by 52 equates to the annual emissions from this car travel (2.37x52) **123.24 tCO₂e per annum**
- Next the emissions from the train travel were taken away from the potential car travel emissions.
- National rail trains emit 0.04kgCO₂e per passenger per km. For the purposes of this calculation an assumption has been made that the train journey would be the same distance as average journey driven, although in reality this is unlikely. (0.04 x 13.2km) This gives the sum of 0.54kgCO₂e per passenger.
- This figure has then been multiplied by the number of residents involved in the 10% target increase which equate to 0.53 tCO₂e ((0.54 x 988)/1000).
- This was then multiplied by 52 to give annual emissions of 27.6 tCO₂e (1.6 x 52).
- Finally this figure was taken away from potential driving emissions to give potential annual carbon emission savings of 94.9 tCO₂e (122.52 – 27.63).
- However, emissions from national rail are out of scope when considering the borough's carbon footprint. So potential carbon savings are the initial figure of **123.24 tCO₂e per annum**.
- These calculations assumes all the car journeys are undertaken within the borough.

Action 2.9 Part B - Deliver transport infrastructure enhancement in Coppid Beach, includes the creation of more parking spaces to achieve a 10% increase in the number of Wokingham Borough residents who use a park & ride at least once a week by March 2026.

- Coppid Beech Park & Ride (P&R) will run users out to Wokingham and Bracknell both an average of 2 miles (or 3.2km) journey.
- An average size petrol car will emit 0.29103KgCO₂ per mile.
- In 2019 8% of Wokingham Borough's residents used P&R at least once a week, this is 13,200 people (165,000 current total population).
- The targeted 10% increase of this is a further 1320 people using park and ride at least once a week.
- This is 135280 miles saved a year ((1320 x 2 miles)x 52 weeks), which would have emitted 40tCO₂e annually ((0.29103 x 135380)/1000).
- There are of course still emissions associated with the bus journey itself. An average local bus emits 0.33KgCO₂e on this journey (0.10391*3.2km).
- Based on the bus timetable for the Winnersh Triangle P&R were buses go on average 4 times an hour 6 days a week for 12 hours a day equating to 568 bus journeys running to and from the P&R emitting 9.8tCO₂e a year.
- Subtracting this figure from the earlier 40tCO₂e emission saving from shorter car journeys leaves us with an **30.1 tCO₂e per annum** from the creation of the Coppid Beech P&R by 2026 to be sustained into 2030.

Action 2.10 - Re-optimising the routes and capacity for school buses by re-tendering the contracts.

- Initial 14 routes covered 93750.49km per year
- Multiplied by the kg per km for euro6 buses (0.04) or 0.265 for one diesel route covering 6054.33
- This equates to 5114.22 kgCO₂e
- New 8 routes cover 52042.83km per year
- Multiplied by the same emissions factors (including identical diesel route)
- This equates to 2562.83 kgCO₂e
- Therefore the change has resulted in 2551.38 kgCO₂e of savings, or **2.55 tCO₂e per annum**

Target 3 - 20% reduction in total distance travelled in private vehicles per individual per year by 2030

- This target aims to reduce demand by encouraging working from home, sharing journeys to work and to local amenities, and reducing the level of freight through better management of the network. National figures are used, as there are no local figures relating to journey length for business, local trips or freight within the borough.
- The average miles travelled by car in the South East region and Rural-Urban Classification for 2018/2019 were 4,741 per year for rural Town and Fringe. This is used as the latest BEIS data available is from 2019.
- There are 66,100 petrol cars registered in Wokingham as of December 2019. The average miles per year driven for these vehicles is approximately 313,380,100 (66,100 x 4741).
- Therefore a 20% reduction would save 62,676,020 (313,380,100 *0.2) miles

- The average petrol car emits 0.29103 kgCO₂e per mile.
- Therefore, a 20% reduction in total distance travel will result in savings of **18,240.60 tCO₂e per annum** (62,676,020 x 0.29103/1000)
- There are 33,900 diesel cars registered in Wokingham as of December 2019. The average miles per year driven for these vehicles is approximately 160,719,900 (33900 x 4741).
- Therefore a 20% reduction would save 32,143,980 (160,719,900 *0.2) miles
- The average diesel car emits 0.27901 kgCO₂e per mile. Therefore, a 20% reduction in total distance travel will result in savings of **8968.49 tCO₂e per annum** (32,143,980 * 0.27901/1000)
- There are 38,000 motorbikes registered in Wokingham as of December 2019.
- The average miles travelled by motorbike in the South East region and Rural-Urban Classification for 2017/2018 were 30 for rural Town and Fringe.
- The average miles per year driven for these vehicles is approximately 1,140,000 (38,000 x 30).
- Therefore a 20% reduction would save 228,000 (1,140,000 *0.2) miles
- The average motorbike emits 0.16559 kgCO₂e per mile. Therefore, a 20% reduction in total distance travel will result in savings of **37.75 tCO₂e per annum** (228,000* 0.16559/1000)

Total savings across all 3 of these vehicle types is therefore **27,246.84 tCO₂e per annum**.

Action 3.1 - Engage businesses to promote homeworking and remote working when possible to achieve 30% reductions of CO₂ emissions travelled from employees of local businesses by 2022

- There are a total of 60,800 Wokingham Borough residents employed in the following roles which are office based and therefore could sustain remote working behaviours which have been enforced through the COVID-19 lockdown measures in 2020.

	Wokingham (Numbers)
Managers, Directors And Senior Officials	12,600
Professional Occupations	27,100
Associate Professional & Technical	14,100
Administrative & Secretarial	7,000
Total	60,800

- Assuming 30% (18,240 people) of the office-based workforce can maintain remote working or active travel to and from work this could lead to huge annual reductions in local car travel and associated emissions.
- In England in 2018, the average person travelled 788 miles per year for commuting purposes by driving a car or van. 14.4 million miles are therefore travelled each year by 30% of this sector of the workforce (788 x 18,240).

- Multiplying this mileage by 0.29103KgCO₂ of emissions per mile by an average petrol car ((0.29103 x 14.4)/1,000) means that **4,200 tCO₂e could be saved per annum** if sustained.

Action 3.2 - Promote the Liftshare scheme through My Journey to help individuals and businesses develop bespoke travel policies

- The target is to achieve a 10% reduction in the number of car/bike trips to and from businesses within the borough by March 2025 by implementing a lift share scheme.
- The average miles travelled by car in the South East region and Rural-Urban Classification for 2017/2018 were 4741 for rural Town and Fringe.
- There are 66,100 petrol cars registered in Wokingham as of December 2019. The average miles per year driven for these vehicles is approximately 313,380,100 (66,100*4741).
- The average petrol car emits 0.29103 kgCO₂e per mile. Therefore, the carbon emissions for the 66,100 vehicles in the Borough will account for 91,203.01 tCO₂e (313,380,100*0.29103/1000)
- A 10% reduction in total distance travel will result in **9,120.30 tCO₂e per annum** (91,203.01 *0.10).
- There are 33,900 diesel cars registered in Wokingham as of December 2019. The average miles per year driven for these vehicles is approximately 160,719,900 (33900 x 4741).
- Therefore a 10% reduction would save 16,071,990 (160,719,900 *0.1) miles
- This translates to carbon savings of **4,484.24 tCO₂e per annum** (16,071,990 *0.27901/1000).
- There are 38000 motorbikes registered in Wokingham as of December 2019.
- The average miles travelled by motorbike in the South East region and Rural-Urban Classification for 2017/2018 were 30 for rural Town and Fringe.
- The average miles per year driven for these vehicles is approximately 1,140,000 (38000 x 30).
- Therefore a 10% reduction would save 114,000 (1,140,000 *0.1) miles
- The average motorbike emits 0.16559 kgCO₂e per mile. Therefore, a 10% reduction in total distance travel will result in **18.87 tCO₂e per annum** savings (114,000 * 0.16559/1000)

Therefore total savings for this target are **13,623.41 tCO₂e per annum**

Target 4 The use of all cars, vans and motorbikes as a mode of transport decreases from 74% (current national/borough average) total miles to 56% in 2030

- There are 138000 cars, vans and motorbikes registered in the Borough. Assuming that the council target is to achieve a further 18% reduction from the current national average of 74%, the carbon savings will result in **24,522.16 tCO₂e per annum**.

	Petrol Car	Diesel Car	Motorcycle	Total
Average annual miles	4741	4741	30	
No vehicles	66,100	33,900	38,000	138,000
Total miles	313,380,100	160,719,900	1,140,000	475,240,000
18% saving	56,408,418	28,929,582	205,200	85,543,200
tCO₂e saved	16,416.54	8,071.64	33.98	24522.16

Action 4.1 - To provide more primary school children with the opportunity to develop practical skills and an understanding of how to cycle safely, leading to greater chance of adoption, both now and in the future.

- Currently there are approximately 2000 children trained across all levels of bikeability at the boroughs primary schools each year.
- On average, children travel 1.6 miles to primary school⁵. Multiplying these figures together means 6,400 miles are travelled per day to and from school by these children ((1.6 x 2000) x 2).
- There are 190 days in an academic year meaning this small group of children will be travelling 1,216,000 miles per year (6,400 x 190). If assuming these children will all transition from being driven to and from school to cycling to and from school:
- Multiply this figure by the carbon emissions produced per mile driven in an average sized petrol car ((1,216,000 x 0.29103KgCO₂e)/1000) to find that **353.89 tCO₂e emissions could be saved per academic year**

Action 4.2 - Encourage and support local schools to join Modeshift Awards scheme for active and sustainable travel to achieve a 10% reduction in the number of children being driven to school by March 2026.

- There are 21,757 children in the borough who attend a state primary or secondary school in the borough. 35.79% are driven to school equating to 7,786.8 pupils.
- A 10% reduction of those being driven is therefore 778.7 less pupils being driven to school.
- Children travel on average 3.2 miles a day to and from primary school in England. Multiplying this figure by the 10% reduction aimed for is 2491.8 miles travelled per day (778.7 x 3.2).
- This is then multiplied by 190 (school days) to calculate annual mileage by this cohort 473439.3 miles per academic year (2491.8 x 190).
- Finally this figure is then multiplied by the emissions per mile produced from an average sized petrol car shows potential savings of **137.7tCO₂e per annum** ((473439.3 x 0.29103)/1000).

⁵https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/476635/travel-to-school.pdf

Action 4.3 - Role out the Healthy School Streets programme to help achieve a 10% reduction in the number of children being driven to school by March 2026.

- See the calculations for Action 4.2 as this will help towards achieving these **137.7tCO₂e** a year.

Action 4.4 - Increase the uptake of cycling from local business by promoting the Love to Ride programme to reduce the CO₂ emissions from a driven commute by 10%.

- There are 85,900 economically active residents in Wokingham Borough. We are assuming they all currently commute to work in this calculation.
- 63% of residents in Wokingham Borough usually drive to work, equating to 54,117 residents.
- A 10% reduction and shift to active transport for work would be 5,411.7 people who usually drive to work.
- The average annual mileage for commuting is 788 miles. Multiply these figures together equates to 4,264,420 miles a year (5411.7 x 788).
- Multiplying this figure by the emissions per mile of an average petrol car shows that **1,240 tCO₂e per annum** can be saved a year from this amount of people shifting their annual commute to zero emission modes ((4,264,420 x 0.29103)/1,000).

Action 4.5 - Develop the Local Cycling and Walking Infrastructure Plan (LCWIP) to be borough wide and implement 50% LCWIP by 2030 to increase cycle modal share by 4% and increase walking modal share by 5%.

- The total annual mileage in the borough by all modes is 475,240,000.

Cycling

- National Modal Share by distance travelled for cycling is 1%. This equates to 4,752,400 miles in Wokingham Borough (475,240,000*0.01).
- The target increase to 5% share would mean a rise to 23,762,000 miles being cycled rather than driven (475,240,000*0.05)
- This is a difference of 19,009,600 miles (23,762,000-4,752,400)
- Multiplying this figure by the emissions per mile of an average sized petrol car means saving up to **5,532.36 tCO₂e per annum** ((19,009,600 x 0.29103)/1,000)

Walking

- National modal share by distance travelled for walking is 3%. This equates to 14,257,200 miles a year in Wokingham Borough.
- An increase to 8% of modal share would be a further 23,762,000 miles a year walked instead of driven (4,752,400*5)
- This would mean **6,915.45 tCO₂e** could be saved annually ((23,762,000 *0.29103)/1000)

Therefore the total savings from this action would be **12,447.81 tCO₂e per annum**

Action 4.6 - Deliver engagement and cycle training events across the Borough to achieve a 2% increase in the number of Wokingham Borough residents regularly walking and cycling for leisure and utility by March 2022 (excluding over 60s).

Cycle

- In 2019 it is thought that 38% of Wokingham Borough residents cycle at least once a week. We have clarified this target by using only the working age population of the borough 103,000 as children and over 60s are covered in other targets. 38% of this figure is 39,140 residents cycling at least once a week (103000×0.38).
- A 2% increase will be 2,060 more residents cycling regularly.
- The average length of a cycle ride in the UK is 3.3 miles. Therefore, weekly mileage from this 2,060 residents is 6,798 miles a week cycled (3.3×2060), assuming this is instead of driving.
- Multiplying this figure by the emissions per mile of an average petrol car and further multiplying this by 52 weeks in a year equates to annual emissions of these journeys if driven to be **102.88 tCO₂e per annum** ($((6798 \times 0.29103) \times 52) / 1000$).

Walking

- 92% of Wokingham Borough residents walk at least once a week which is 94,760 people.
- A 2% increase is 2,060 residents.
- Annually, the average walking miles for people living in 'rural towns and fringe' regions is 183 miles or 3.5 miles per week.
- Therefore this 2% increase in residents walking will save 376,980 miles (183×2060) which would have otherwise been driven (assumption).
- These miles, if driven, would emit a total of **109.71 tCO₂e per annum** ($(376,980 \times 0.29103) / 1000$).

Therefore the total savings from this action would be **212.59 tCO₂e per annum**

Action 4.7 - More residents over 60 riding bikes for travel to achieve a 3% reduction in car use by residents over 60.

- 39,468 residents who are 60 or over according to the mid-2019 population estimates.
- Assuming an average annual mileage driven is 4741 miles. Total miles for this group is 187,117,788 a year ($39,468 \times 4741$)
- A 3% reduction on this would represent a fall of 5,613,533.64 miles ($187,117,788 \times 0.03$)
- Emissions for this amount of mileage is **1,633.71 tCO₂e per annum** ($(5,613,533.64 \times 0.29103) / 1000$).

Action 4.12 – 22% decrease in road freight

- Currently 8,400 LGVs and 700 HGVs

- Average van mileage is 13,000 per year⁶
- At 0.41028kg per mile for average diesel vans
- Therefore $(0.41028 \times 8400 \times 13000 / 1000) = 4,4802.576 \text{ tCO}_2\text{e}$
- Average lorry mileage is 62,751 per year⁷
- At 1.38502kg per mile with average load
- Therefore $(1.38502 \times 700 \times 62,751 / 1000) = 60,837.97 \text{ tCO}_2\text{e}$
- In total then a reduction by 22% would save **23,240.92 tCO₂e per annum**
($60837.97 + 44802.576 \times 0.22$)

Target 5. Leading by example – Reduce by 70% CO2 emissions produced by council related travel by 2030

- A staff travel survey carried out in 2020 to WBC staff in 2020 showed that approximately 3,482,615 miles are driven to WBC workplaces annually (pre-covid).
- In addition, Council staff travelled an estimated 896,957 miles for council work this year.
- Therefore, total staff mileage is 4,379,572 per year.
- A 70% reduction in this total would be 3,065,700.4 less miles ($4,379,572 \times 0.7$)
- This would therefore save **892.21 tCO₂e per annum** ($3,065,700.4 \times 0.29103 / 1000$).
- Council EV adoption targets 8 and 7.5 also contribute towards the overall 70% reduction, with the specific 8.1 action's savings included in this total.

Action 5.1 - Deliver a strategy to reduce grey fleet miles from work related trips by 30%

- Grey Fleet is a term used to describe the business miles travelled by an employee in their own vehicle. This 'fleet' of employee-owned cars is deemed 'grey' as the vehicles in use are in somewhat of a grey area of responsibility for the employer.
- Council staff travelled 896,957 miles for council work this year.
- 30% of this is 269,087.1 miles ($896,957 \times 0.3$)
- Therefore this reduction would save **78.31 tCO₂e per annum** ($269,087.1 \times 0.29103 / 1000$).

Action 5.2 - Promote homeworking and remote working practices amongst council staff to reduce by 40% the CO2 emissions travelled from council staff to work by 2022.

- A staff travel survey carried out in 2020 to WBC staff in 2020 showed that approximately 3,482,615 miles are driven to WBC workplaces annually (pre-covid)
- These journeys cause the emission of approximately 1,013.54 tCO₂e each year
($(3,482,615 \times 0.29103) / 1000$).

⁶

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/611304/annual-road-traffic-estimates-2016.pdf

⁷ <https://afdc.energy.gov/data/10309>

- A 40% reduction of this would therefore represent **405.42 tCO₂e per annum** of savings annually (1,013.54*0.4)

Action 5.3 - Incentivise council staff to mode shift to active and sustainable transport to reduce by 30% the CO₂ emissions from staff travelling to work by 2025.

- A 30% reduction would be as above but **304.06 tCO₂e per annum** of savings (1,013.54*0.3).

Target 6. Continue research and innovation programmes for the reduction of CO₂

Action 6.1 - Continue to research and use innovative techniques to manage traffic and encourage uptake of sustainable modes and ultra-low emission options.

Please see action 4 for the full calculations for the below table, with the only change being a switch to 10% rather than 18%.

	Petrol Car	Diesel Car	Motorcycle	Total
Average annual miles	4741	4741	30	
No vehicles	66,100	33,900	38,000	138,000
Total miles	313,380,100	160,719,900	1,140,000	475,240,000
10% saving	31,338,010	16,071,990	114,000	47,524,000
tCO₂e saved	9,120.30	4,484.25	18.87726	13,623.42

- This action would therefore result in **13,623.42 tCO₂e savings per annum**.
- This is in addition to below as it is achieved by improvements in engine efficiency and traffic solutions rather than a switch to active/sustainable methods.

Action 6.2 - Mobility as a service (MaaS) and future proofing the network.

- Following the same calculations as above, this action would achieve another 10% savings, resulting in another **13,623.42 tCO₂e savings per annum**.

Savings this year

- Due to the significant impacts of covid on public transport, homeworking and travel restrictions, it is nearly impossible to base savings on these usual annual figures.
- However, according to government statistics, from the 16th of March 2020 when non-essential travel was stopped until the 12th of April 2021 when restrictions began to ease, car use dropped by an average 31%.⁸

⁸ <https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic>

- Excluding motorcycles, which are not included in these findings, this new total would suggest that (146,971,000) miles less were driven as a result of the above (474,100,000*0.31)
- Approximately 66% of this is petrol and 33% of this is diesel
- This relates to savings of 13,532.1 tCO₂e for diesel (146,971,000*0.33*0.27901/1000)
- And savings of 28,230.16 tCO₂e for petrol (146,971,000*0.66*0.29103/1000)
- Therefore, total savings of at least 41,762.26 tCO₂e were achieved within the borough, demonstrating the significance of these measures were this to continue in future. This is just for cars so the actual figure will likely be greater.

Electric Vehicles

Target 7 - 50% Electric Vehicles (EVs) registered in the Borough by 2030.

There 148,300 vehicles register in Wokingham at the end of 2019. Of these, 808 are ultra-low or electric vehicles.

Wokingham registered vehicles	Q3 2019	%
ULEVs [1]	808	0.54
Cars [2]	100,000	
Diesel cars	33,900	22.86
Petrol cars	66,100	44.57
Motorcycles [2]	38,000	25.62
Light Good vehicles (LGVs) [2]	8,400	
Diesel LGVs	8,000	5.39
Petrol LGVs	400	0.27
Heavy Good Vehicles (HGVs) [2]	700	0.47
Buses & coaches [2]	300	0.20
Other [2]	900	0.61
	148,300	

- The government predictions estimate that by 2030 there will be a national average uptake of EVs by 25%.
- A battery electric vehicle carbon emissions accounts to 0g CO₂ per kilometre.
- Carbon emissions by transport account for 184.08 ktCO₂e; these are projected to decrease to 138.06 ktCO₂e by 2030 following the 25% decrease from government predictions on transport electrification.
- A further 25% of EV uptake will therefore result in an additional **46,020 tCO₂e per annum** reduction by 2030 (184.08*0.25*1000)
- It is projected that by implementing a Borough wide EV strategy, adding charge points in strategic locations, giving residents the opportunity to charge easily, reduce range anxiety for EV users, the uptake to electric vehicle is accelerated by a further 25%.
- The 50% switch to EV refers to personal transport (cars and motorcycles) and light vans only, as electrification of larger goods vehicles is not currently mainstream, however as technology develops this can be reviewed.

- Therefore, the total annual saving for switching to 50% EV's will be 91,250 tCO₂e reduction by 2030.

Action 7.3 - Review the residential charge point infrastructure for those who have communal parking facilities such as flat developments through an initial pilot of 18 new charging point for residents generating associated carbon emission savings.

- The initial pilot will be accessible to approximately 27% of households equating to 12,000 households.
- Currently EVs account for 0.54% of the total vehicle ownership share in the borough.
- 94% of households in the borough own a car. This is 10,800 households in this pilot (12000 x 0.9).
- Currently 58.3 EVs would be owned in this cohort (10800 x 0.0054).
- There are currently around 20 charging locations around the borough. An increase of 18 new charge points results in a 90% increase.
- Therefore there is capacity for a 90% increase in the 58.3 EVs owned. This equates to 52.5 new EVs on the road in the borough.
- Driving an average annual mileage for a rural town or friend region this would save 247,480.2 miles a year driven by internal combustion engine cars (52.2 x 4741 miles).
- This mileage would emit **72.02 tCO₂e per annum** ((247,480.2 x 0.29103)/1000).

Action 7.5 - Support local businesses, including commercial property owners, to transition their commercial fleets to EV and encourage their employees to switch to EV for private use to achieve a 20% transition to EVs.

- In 2017 it was found that 40% of all vehicles in the UK can be considered as grey fleet. In Wokingham Borough that would mean that 40,000 cars are used predominantly for commuting and business travel (100,000 x 0.4).
- The target aims to support the transition of 20% of this fleet 8,000 cars to EV (40,000 x 0.2).
- Average commuting miles in the UK is 788 miles annually. Therefore this 20% travels 6,304,000 miles every year (8000 x 788).
- Assuming the majority of these cars are petrol the emissions produced from this travel is **1,834.6 tCO₂e per annum** ((6,304,000 x 0.29103)/1000). This is the amount that could be saved by transitioning 20% of commuting vehicles to EVs.
- More information will be available at a later stage as we identify the number of taxis businesses operating in in the borough and the feasibility of these transitioning to EV.

Target 8. Council's car fleet becomes entirely ultra-low emission by 2028.

The council has currently 19 vehicles, of which 16 are owned and 3 are leased, as shown below:

Owned

Hyundai 1800 2.5 CRDi 5 dr MPV	5000
Ford Connect 210 LWB 1.6 95ps Van	12000

Ford Ranger Pick-Up (54 reg.)	7000
Rodeo Denver Max D/C Pick-Up (2009)	7000
Ranger XL 4x4 TDCI	10000
Landini Agricultural Tractor	7675
Peugeot Expert Professional	7675
EV Van	7675
Ford Tourneo Connect 8-Seat Minibus	2400
Ford Transit Connect Van	7675
Vauxhall Vivaro 9 seat Minibus (2012)	7675
Ford Transit Tourneo 9-Seat Minibus (2009)	7675
Ford Transit 17-Seat Minibus	7675
Ford Tourneo Connect Trend 8-Seat Van	7675
Ford Transit 17-Seat Minibus	7675
Nissan E-NV200 Panel Van (Electric)	7675

Leased

Vauxhall Vivaro Combi	7675
Ford Transit Connect 1.8	7675
Citroen Berlingo Van 1.6	7675

- For vehicles with currently unknown mileage and average of known mileage was used = 7675. Please note the true value may be significantly lower.
- Total annual emissions are therefore **45.39 tCO₂e per annum**, following the GHG Accounting tool emission factors where this is used (this includes energy for the EV's).

Savings this year

- Between 2020 Q4 and 2021 Q3 (Latest available data) the number of ultra low emission vehicles in the borough rose by 321
- This represents carbon savings of 442.91 tCO₂e by taking petrol cars off the road (321*4741*0.29103/1000)

Renewable Energy Generation in Council's owned assets

Target 12. Increase the generation of renewable energy through investment in solar farms to power the equivalent of 25,000 homes within the Borough by 2030.

- Renewable electricity for Wokingham as 2019 accounted for 41,155 MWh **per annum** (BEIS Latest).
- Emissions associated with the generation of electricity at a power station. Electricity generation factors do not include transmission and distribution.
- The overall objective for the council is to generate 40,000,000 kWh per annum of electricity by 2026 and have an aspiration to generate 100,000,000 kWh per annum (for possible excess commercial retail) within the Borough by 2030.
- Based on a 4000 kWh per annum average usage / per average domestic property. Therefore, 40,000,000 MWh of electricity generation has the potential to feed

10,000 homes, and 100,000 MWh of electricity generation has the potential to feed 25,000 homes.

- Using the UK Government GHG Conversion Factors for electricity generated 0.2556, 100,000 MWhs of electricity have a potential to produce carbon savings of **25,560 tCO₂e per annum**.

Year	Target	Unit	No. residential properties electricity equivalent	kg CO ₂ e	tCO ₂ e
2023	20,000,000	KWh	5,000	5,112,000	5,112
2026	40,000,000	kWh	10,000	10,224,000	10,224
2030	100,000,000	kWh	25,000	25,560,000	25,560

- It is estimated that each solar farm installed will have the capacity to generate in excess of 20 MWh of energy, this depending on land size availability. Estimated carbon savings for a solar farm under this conditions account for 5,112 tCO₂e and potential to feed 5,000 homes.

Target 13. Increased renewable energy generation to generate equivalent to 1550 kWh per household in 2030

- There are approximately 2,112 installations of renewable energy in Wokingham, which generates 41,155 MWh renewable electricity (BEIS Sept 2019). Of this, 2,106 are photovoltaics.
- The inventory data used for this exercise is the current reported generation per annum for Wokingham.
- Baseline data for small-scale photovoltaics generation as reported by SCATTER is currently 26,984.5 MWh. This data is not based on any detailed technical feasibility; rather the national generation is scaled by number of households, land area, etc.
- The projected pathway data provided by SCATTER, refers to the anticipated generation calculated in 2030. Total small-scale solar PV is calculated in TWh generated, based on defined rates of total installed capacity (GW). The TWh/GW capacity generation efficiencies from 2017 - 2030 are taken from the National Grid's Two Degrees scenario (2019) for large scale solar PV, but the year on year rates of change are applied to the domestic / small scale solar PV recorded.
- The estimated annual generation for the borough by 2030 is 106,938.43 MWh per annum.
- Carbon savings from the increase in small-scale renewable generation can be obtain using the UK Government GHG Conversion Factors for electricity generated 0.2556kgCO₂e. This will account for **27,333.46 tCO₂e per annum**.

Small-scale PV generation	MWh	KWh	kg CO ₂ e	tCO ₂ e
Baseline	26,984.53	26,984,530.85	6,897,246.086	
2030 pathway	106,938.43	106,938,426.76	27,333,461.88	27,333.46

Action 13.1 Set up a Community Energy Fund for Wokingham, and through this generate an average of 27,000 kWh/year of renewable energy from the installation of small-scale PV systems funded through this scheme.

- From the below table, it is shown that this energy generation related to an estimated carbon saving of **6.90 tCO₂e per annum**.

KWh	kg CO ₂ e	tCO ₂ e
27,000 per year	6,901.20	6.90

Action 13.2 Support residents and local businesses to reduce their energy usage and carbon emissions and increase the uptake of renewable energy installations through the green bank scheme

- It is estimated that 15,000 households apply for funding for the installation of PV through the Green Bank scheme over the next ten years.
- Typical small-scale UK installations are around 15 to 25 square metres. A 3kWp system could comprise 15 panels taking up an area of 20 square meters and will generate roughly 2,500kWh per annum⁹
- Estimated carbon savings **9,585 tCO₂e per annum**.

	kWh/annum	kgCO ₂ e	tCO ₂ e
1 SCPV generates 2,5000	2,500	639	0.639
15,000 households	37,500,000	9,585,000	9,585

Savings this year:

With the generation of 42,572.84 MWh renewable electricity in the last recorded year (2020), the borough saved 10,881.62 tCO₂e against fossil fuel sources (42,572.84*0.2556).

Retrofitting Council and Commercial Property

Target 14. By 2028 All council buildings to be retrofitted to carbon neutral standards

- The council estates / corporate property portfolio (CCS contract) energy usage figures are for electricity 5,855,473.6 kWh per annum and for gas 9,088,705 kWh per annum as per 2018 baseline. This data does not include energy figures for schools, as these are been addressed in target 15. Therefore, electricity related emissions for the council estate are 1,496.66 tCO₂e per annum.
- An additional 3,259 tCO₂e per annum to the total carbon emissions for the council estate have been added to equate for transmission and distribution factors.
- Gas emissions for the council estate accounts for 4,058 tCO₂e per annum (2018 baseline year).
- The total carbon dioxide emissions council estates / corporate property portfolio excluding schools for 2018 baseline are **6,612.30 tCO₂e**.

⁹ Renewable Energy Sources, Carbon Trust 2018

Council Baseline (2018)	Electricity kWh	Electricity tCO ₂ e	Gas kWh	Gas tCO ₂ e
Council Property	5,855,473.60	1,496.66	9,088,705	1,856.64
Transmission and distribution factors		3,259.00		
Total CO2 emissions				6,612.30

Action 14.2 Gorse Ride Regeneration Project

- The Gorse Ride development consists of the state regeneration of 255 houses which will be design to net-zero carbon standards with no supply of domestic gas.
- Following the calculations in action 16, the average emissions per house is 3.67 tCO₂e per annum
- The 255 houses in this regeneration project will therefore provide savings of **935.85 tCO₂e per annum** once completed (255 x 3.80).

Action 15 Improve energy performance of council housing stock

- There are approximately 2,600 council owned houses. Assuming these were retrofitted to carbon-neutral standards and domestic gas were to be removed.
- The Borough's carbon footprint for domestic gas is 186.9 ktCO₂e and for domestic electricity is 59 ktCO₂e, with 10.8 ktCO₂e from other fuels (BEIS 2019), generating a total of 256.7 ktCO₂e.
- As of 2019, there were approximately 70,000 houses registered in the Borough. It is assumed that the carbon footprint per house is 3.67 tCO₂e (256.7/70,000*1000).
- The 2,600 council owned houses will provide carbon savings of **9,542 tCO₂e per annum** (2,600 x 3.67 tCO₂e).

Target 16. By 2029 all local schools will be retrofitted

Council Baseline (2018)	Electricity kWh	Electricity tCO ₂ e	Gas kWh	Gas tCO ₂ e
Schools	9,284,409.41	2,373.10	13,026,155	2,660.98
Total CO2 emissions schools				5,034.08

- Energy figures for schools for electricity are 9,284,409.4 kWh per annum and gas 13,026,155 kWh per annum as per 2018 baseline.
- Considerations for transmission and distribution factors have already been accounted for in the council estates and corporate portfolio carbon footprint.
- Therefore, electricity related emissions for schools are 2,373.10 tCO₂e and gas related emissions are 2,660.98 tCO₂e per annum.
- Therefore, total potential savings are **5,034.08 tCO₂e per annum**.

Target 17. By 2030, 20% of households to be retrofitted to deep retrofit standard as defined by Scatter

- There were approximately 70,000 households registered in the borough in 2019.
- It is assumed that the carbon footprint per house is 3.67 tCO₂e (256.7/70,000*1000).
- The current Government ambition is to achieve a 10% reduction in energy used for heating in existing homes by 2030¹⁰. If applying this scenario, by 2030, 7,000 houses should have been retrofitted to carbon neutral standards.
- The council ambition is to encourage residents to retrofit their homes by a further 10%, achieving 20% of the households registered in the Borough to be retrofitted to carbon neutral standards.
- Therefore, potential savings from this additional 10% represent **25,690 tCO₂e per annum** (7,000*3.67)

Households	Existing homes	tCO ₂ e
Government ambition 10%	7,000	25,690
Council ambition 10%	7,000	25,690
20% Households	13,057	51,380

Carbon Sequestration

Target 18. Plant 250,000 trees throughout the Borough by 2025

The target to plant 250,000 in the Borough is projected to result in a habitat change that will capture an additional **3,100 tCO₂e per annum**. The number of trees is expected to require approximately 250 hectares of land, as this is a good density for biodiversity and planting for high forest.

- This has a carbon sequestration potential of 7.83 tonnes of CO₂e equivalent per hectare in first year of planting, 13.7 tonnes thereafter.
- With some of this 250 hectares to be things like access roads, glades, rides for biodiversity etc, this means a total of 226.27 hectares will be converted.
- Therefore $226.27 * 13.7 = \mathbf{3,100 \text{ tCO}_2\text{e per annum}}$

This is the estimated yearly saving, 2 years after project completion. Trees planted for the project will be UK and Ireland Sourced and grown. This will help with reducing the risk of pests and disease as well as reducing the carbon emissions related to transporting trees from overseas. It is estimated that the cumulative carbon savings by year 2030 will be 16,916 tCO₂e. We do not have figures for the estimated carbon savings for each individual action here.

Target 19. Carbon sequestration by design - improving carbon sequestration rates in future land management decisions

- Allocated sites within current iteration of the LPU sum to 460ha. On the basis that approximately a quarter of this is nudged towards being green infrastructure with a high carbon sequestration rate (mix of woodland and species rich grassland with roughly 8 tCO₂e per ha sequestration rate) and half the green infrastructure is

¹⁰ UK housing fit for the future? Committee on Climate Change 2019.

delivered by 2030, the policy and strategy focus will cause 460 tCO₂e benefit by 2030.

- Alongside this, if the Local Nature Recover Strategy and Natural Flood Management approach can tilt the balance that an additional 20ha of land use change (at a similar sequestration rate to green infrastructure above) is supplied to the BNG and environmental services markets by 2030 then this will lead to another 160 tCO₂e per year.
- Total estimated carbon sequestration **660 tCO₂e per year**.

Action 19.1 Develop the Wokingham Borough Tree Strategy to support long-term creation and retention of woodland and trees.

- Improving the retention rate of trees and encouraging planting of woodland on private land - The longer trees are standing the longer carbon is locked up.

Action 19.2 Include in the Local Plan Update policy for carbon sequestration potential.

- Assuming roughly 70ha of green infrastructure created in the LPU cycle. A nudge of 10% cover from high intensity maintenance grassland to low intensity species rich, brought about by good design guiding, could sequester a further **42 tCO₂e per year**.

Action 19.3 Develop the Local Nature Recovery Strategy to provide complementary funding source to aid land use change (LULUCF being a carbon sink)

- On assumption that average of 2.5 units per ha (not including current woodland area) can be generated @ £15,000 per unit, the 5% uplift on a LNRS (over and above the national strategy area) would generate value on the biodiversity potential of £5,276,250

Action 19.4 Develop a Natural Flood Management partnership and scheme

- Within Natural England's Research Report 43, the change of use from arable land to wetland has examples of carbon sequestration rates of circa 8 to 17 tCO₂e per hectare per year.
- Working from figures in the report, on the basis that soil carbon loss under agriculture might be at a rate of 0.6% per year and carbon stocks for this habitat average 43 tCO₂e per hectare, natural flood management measures that prevent degradation might prevent **0.25 tCO₂e** per hectare being released into the atmosphere.

Target 20. Transition to low intensity (high carbon sequestration) land management

Action 20.1 Work to transition Grassland Management to less frequent cutting scheme allowing wildflowers to bloom and set seed

- A goal of **642 tCO₂e per annum** would be targeted to be met in the period 2025 to 2030.

Action 20.2 Work to transition Grassland Management to support the Restoring Biological Processes

- Converting 1/3 of the approx. 125ha of improved grassland within Environmental Localities portfolio to species rich grassland on a once a year cut could sequester an additional 242 tCO₂e per year (33% of 125 x 5.87, for conversion rate of improved to pollen and nectar mix from NERR043).
- Converting rural highways verge to cut and collect, estimate of 4 tonnes per hectare would equate to 400 tonnes CO₂e per year for 100% conversion. 5% pilot is estimated to have the potential to sequester 20 tonnes of CO₂e per year.
- Therefore, a total of **642 tCO₂e per annum** would be sequestered.

Action 20.3 Implement Citizen Science Engagement for Hedgerow Restoration

- One mature oak tree is estimated to be 10.5 tCO₂e. If hedgerow restoration can be encouraged through use of a streamlined assessment and interpretation tool and this nudges to increase the % of hedgerow with oak standards up by just 1% in the borough, this will equate to (approximately) an additional 3,200 tCO₂e captured over the next 70 years.
- 300 extra open growing oak trees (or equivalent are planted by 2025 with a pro rata tCO₂e sequestration rate of **45 tCO₂e per annum**.

Savings this year:

- Alongside hedgerows and grassland management, the 15,400 trees planted since October have contributed towards offsetting at least an estimated 2,310 tCO₂e (15,400*0.15)
- If one young tree saves approximately 1/100 of a mature one, this is 0.15 tCO₂e.
- This is an estimation as it is impossible to exactly calculate, but with the additional measures such as hedgerows etc this is a more accurate figure.

Schools and Young People

Carbon savings in this section are primarily defined in the report as neutral as they primarily contribute back into other areas within the plan, however there are some estimates provided here which reflect on the individual targets, based on some available data.

The carbon savings associated with the targets below have been reduced from last year's estimates by 79% in line with the consumption-based UK carbon footprint which informs us that only 21% of all greenhouse gas emissions are from direct sources and therefore within our scope of influence.

We have made the decision to lower these predicted savings also to ensure that there is less risk of double counting of carbon savings whilst realising that possible behaviour change as

a result of engagement means and accelerated the shift to more sustainable behaviours and therefore drives carbon emissions down further by 2030.

Target 22 - Encourage and support school children in the Borough to take an active role in reducing carbon emissions

- A study at San Jose State University found that a 9-hour university course on climate change taught over two semesters reduced the annual carbon footprint of each student by an average of 2.86 tCO₂e.
- This figure has been used to calculate the impacts of 1 hour of discussion and education about the climate emergency in the schools in Wokingham Borough.
- Therefore, the average annual carbon saving attached to 1 hour of targeted learning is $(2.89/9) 0.318$ tCO₂e.
- This will be reduced by 50% to 0.159 tCO₂e to allow for lower levels of education and engagement as well as the fact that younger students have less power over purchasing decisions etc. and therefore over their entire carbon footprint.
- Please note that these are all assumptions based on students putting learning into physical action to reduce their carbon emissions and as children, students are less able to make these changes but may encourage their parents/guardians to make changes.

Action 22.1 - Deliver annual climate emergency assemblies at local schools with the aim for every year group in each secondary school to receive an assembly annually.

- Assemblies are around 20 minutes, meaning the sessions of learning will have at least two thirds less impact than a full hour of learning the aforementioned study these assumptions are based on. The carbon reduction impact of one assembly per student is therefore 53 KgCO₂e $((0.159/3) \times 1000)$.
- There is an average of 161 pupils in a year group meaning the impact of one assembly to a year group is 8.5 tCO₂e $((53 \times 161)/1000)$.
- With 5 year groups in each of the 11 secondary schools across the borough there are 55 assemblies to deliver each year with the potential carbons savings of 469.3 tCO₂e (8.5×55) .
- As the San Jose study saw a decrease in students total carbon footprint, this includes out of scope consumption emissions such a purchase and food choices. The UK's carbon footprint is 21% direct and 79% indirect (consumption) emissions. Therefore, we can only claim for 21% of this figure as savings towards our total carbon footprint. Total savings are **98.5 tCO₂e per annum** (469.3×0.21) .

Action 22.2 - Create climate committees in schools to increase engagement with climate emergency issues and ownership of actions to reduce carbon dioxide emissions.

- One committee of teachers/parents etc per school starting with the 11 secondary schools in the borough.
- Full, voluntary engagement for one hour of training per year for approximately 15 members will save 0.318 tCO₂e, as above.

- This amount will then account for any trickle down of various campaigns and activities around the school. Per committee this will be 4.77 tCO₂e (0.318 x 15).
- One committee in each of the borough secondary schools therefore has the potential to save 52.47 tCO₂e per cohort (4.77 x 11)
- As the San Jose study saw a decrease in students total carbon footprint, this includes out of scope consumption emissions such as a purchase and food choices. The UK's carbon footprint is 21% direct and 79% indirect (consumption) emissions. Therefore, we can only claim for 21% of this figure as savings towards our borough's carbon footprint. Total savings are **11.01 tCO₂e per annum** (52.47 x 0.21).

Action 22.3 - Deliver the Youth Climate Conference to increase awareness and understanding of climate emergency issues amongst children and young adults attending

- The Youth Climate Conference will occur annually with a duration of 2 hours and maximum capacity of 80 students.
- Two hours of learning per pupil has the potential carbon saving impact of 0.318 tCO₂e (0.156 x 2).
- For full attendance at the Conference that has the potential carbon saving impact of 25.44 tCO₂e annually, providing full engagement and that the cohort changes year on year to maximise audience and reach (0.318 x 80).
- As explained above, we can only claim for 21% of this figure as direct carbon emission savings towards reducing our borough's carbon footprint. Total savings are therefore **5.3 tCO₂e per annum** (25.44 x 0.21).

Action 22.4 - Encourage schools to include climate emergency issues in teaching time to be cover in at least one subject.

- One hour of climate emergency subject matter addressed to an average sized class of 30 pupils could result in emission reduction of 4.68tCO₂ annually (0.156 x 30).
- If this is carried out across the whole of an averaged sized secondary school within the borough of 1130 pupils the saving could be up to **176.3 tCO₂** (0.56 x 1130).
- As explained above, we can only claim for 21% of this figure as direct carbon emission savings towards reducing our borough's carbon footprint. Total savings are **37 tCO₂e per annum** (176.3 x 0.21).

Action 22.7 - Support schools to implement carbon sequestration projects.

- Assuming schools have space and ambition to plant 30 trees on their grounds (the size of a copse or short hedge as recommended by the Woodland Trust). 30 saplings planted sequesters approximately 1.8 tons of CO₂ over 10 years of growth so 0.18 tons on average per year over that decade of initial growth.
- There are 70 non-independent schools in Wokingham borough. With the initial target for 10% of these schools to plant 30 trees, that would mean average savings of **1.26 tCO₂e per annum** (0.18 x 7).

Action 22.8 - Waste reduction: Investigate Freecycle for food schemes, to reduce food from schools going to waste and instead utilise it, either for food banks or homeless shelters.

- 605.59 KgCO₂e is emitted per tonne of food waste going to landfill.
- Schools produced a total of 85,755 kg of food waste across 2021/22. This is therefore 85.75 tonnes (85,755/1000)
- Therefore, by eliminating this it would save **51.93 tCO₂e per annum** (85.75*605.59/1000)
- However, as with all waste savings, this is currently out of scope.

Target 23 - Celebrate schools achievements in climate emergency initiatives and inspire the future generations

Action 23.2 - Nurture creativity and resourcefulness amongst children and young adults through the roll out of the Dragons Den Climate Competition out across all secondary schools in the borough.

- Groups taking part in the competition can be up to 5 pupils. They are likely to have full engagement if taking part as participation is optional.
- Therefore, across an estimated 2 hour period, resulting overall potential savings could be up to 1.59 tCO₂e (0.318 x 5). This is a big impact for a small group of pupils and will include the associated carbon savings of the winning mitigation for the school.
- As explained above, we can only claim for 21% of this figure as direct carbon emission savings towards reducing our borough's carbon footprint. Total savings are **0.34 tCO₂e per annum** (1.59 x 0.21).

Waste & Recycling

The figures used here are calculated based on the premise that preventing the loss of recyclable material means less goes to landfill sites and less is produced, removing the emissions from these processes.

While there are still some emissions from the process of recycling the material itself, these are considerably lower and have been accounted for in the calculations as shown below. All figures are rounded to 2 decimal places for simplicity within this document, although more precise numbers were used to calculate totals, which is why there are some marginal discrepancies.

All figures are based on government figures on GHG reporting where available, or from strong online secondary data where required, with the references outlined in the appendix. While the recycling processes themselves may occur outside the borough, it is the decisions and actions of residents within the borough which allow such actions to happen, therefore meaning they fall into our scope. These savings are calculated to show the potential annual savings per year, therefore acting against the overall emissions and eventually contributing towards the net zero goal. Each of these has been done for the current year due to the considerable changes in actions and results from covid meaning these are the most accurate available.

As mentioned in the full report, target 25 about implementing an re3 contamination policy to reduce contamination has been removed from the current plan as it is currently being reviewed as part of the wider waste strategy, while target 28 has been removed as it has been incorporated into the table and this methodology document in the form of carbon savings. As this is scope 3 emissions these removals have no effect on the total savings.

Target 24 - Eliminate loss of MDR recyclable material in the form of wet paper

- 1,041.84 KgCO₂e is emitted per tonne of paper or board going to landfill.
- 21.32 KgCO₂e is emitted per tonne of paper or board being recycled.
- Total deductions of specifically wet paper/board was (Kerbside and HWRC Recycling)= 3327.92+1.31 = 3329.23
- 583 KgCO₂e is emitted per tonne of raw material produced.
- $(583+1041.84-21.32) \times 3329.23 = 5188.67 \text{ tCO}_2\text{e savings per annum.}$

Target 25 - Achieve 70% recycling target by 2030.

Action 25.2 Improve residents' engagement with waste and recycling initiatives via partner Green Redeem

- By renewing garden waste we therefore expect a similar amount of green waste to be collected and recycled.
- Current amount is 13,247.61 tonnes
- 578.99 KgCO₂e is emitted per tonne of food waste going to landfill.
- 21.32 KgCO₂e is emitted per tonne of food waste being recycled.
- As this is garden waste there is no raw material to substitute for.
- $13,247.61 \times (578.99-21.32)/1000 = 7387.79 \text{ tCO}_2\text{e saving per year}$
- An average of 825 people engaged per post on social media in the baseline year, which is 330 households (825/2.5 average people per household)
- If this many people were to follow the advice and subsequently increase their recycling amount and quality by 10% it would lead to:
 - $(0.22) \times 0.1 \times 330 = 7.31 \text{ tCO}_2\text{e saving per year}$
 - $7.31+7387.79 = \text{A total of } 7,395.10 \text{ tCO}_2\text{e savings per annum.}$

Action 25.3 Target low participation areas to increase food waste tonnage to increase participation above 70%

- Current amount is 6,425.57 tonnes
- Estimated that the average household throws away 1.96kg of food per day¹¹, which is a total of 715.4kg per year
- For 70,000 households this is 50,078 tonnes $(715.4 \times 70,000/1,000)$

¹¹ <https://www.theecoexperts.co.uk/home-hub/food-waste-facts-and-statistics#:~:text=Average%20food%20waste%20per%20household,kg%20of%20food%20per%20day.>

- If 70% of households can recycle all of this waste (or 70% in total for all households), this would therefore send 35,054.6 tonnes to be recycled rather than landfill (50,0078/2)
- 626.91 KgCO₂e is emitted per tonne of food waste going to landfill.
- 21.32 KgCO₂e is emitted per tonne of food waste being recycled.
- 680 KGCO₂e is emitted per tonne of raw material produced on average in Europe.
- $(680+626.91-21.32)*(35,054.6 -6,425.57)/1000 = \mathbf{36,805.19 \text{ tCO}_2\text{e savings per annum.}}$

Action 25.4 Increase & improve facilities for glass recycling

- Current amount is $3,614.38+295.20 = 3,909.58$
- The average UK household uses 500 glass bottles and jars every year¹², which equates to 113kg of glass (8oz per glass bottle)
- Again aiming for 70% of households to recycle all of this (or 70% in total for all households) would mean 5,537 tonnes of glass $(113*70,000*0.7)/1000$
- 8.93 KgCO₂e is emitted per tonne of glass going to landfill.
- 21.32 KgCO₂e is emitted per tonne of glass being recycled.
- 670 KGCO₂e is emitted per tonne of raw material produced.
- $(670+8.96-21.32)*(5,537 -3,909.58)/1000 = \mathbf{1,070.25 \text{ tCO}_2\text{e savings per annum.}}$

Target 26 - Zero waste going to landfill by 2050

Assuming 30% remaining waste, if this is used for combustion to produce energy rather than recycling then nothing goes to landfill. Savings here arise from the prevention of landfill and related emissions and not having to burn fossil fuels.

- The remaining 30% would all be used for combustion
- Remaining amount is $0.3*71624 = 21487.2$ tonnes
- 21.32 KgCO₂e is emitted per tonne from combustion
- 437.37 emitted if going to landfill as residual waste
- Nothing saved from production here.
- $21487.2*(437.37-21.32)= \mathbf{8,939.75 \text{ tCO}_2\text{e savings per annum.}}$

Savings this year:

While it is again impossible to be exact, the main areas (over 500tonnes per year) have been identified below and estimates used based on average figures. For the overall MDR figures a split of 80% cardboard, 5% aluminium and 15% plastic has been used based on the UK average figures. These figures contain life-cycle emission savings which are not included in the current scope so are not used in the summary detail.

For cardboard:

- Current amount is 6,872.41 tonnes $(8590.51*0.8)$
- 1,041.84 KgCO₂e is emitted per tonne of paper or board going to landfill.

¹² <https://www.recyclingbins.co.uk/recycling-facts/>

- 21.32 KgCO₂e is emitted per tonne of paper or board being recycled.
- 583 KGCO₂e is emitted per tonne of raw material produced.
- $(583+1,041.84-21.32) * (6,872.41/1000) = 11,020.05$ tCO₂e saved this year.

For aluminium:

- Current amount is 429.52 tonnes (8590.51*0.05)
- 8.93 KgCO₂e is emitted per tonne of aluminium going to landfill.
- 21.32 KgCO₂e is emitted per tonne of aluminium being recycled.
- 1,570 KGCO₂e is emitted per tonne of raw material produced.
- $(1,570+8.93-21.32) * (429.52/1000) = 669.02$ tCO₂e saved this year.

For plastic:

- Current amount is 1288.58 tonnes (8590.51*0.15)
- 8.93 KgCO₂e is emitted per tonne of plastic going to landfill.
- 21.32 KgCO₂e is emitted per tonne of plastic being recycled.
- 6,000 KGCO₂e is emitted per tonne of raw material produced.
- $(6,000+8.93-21.32) * (1,288.58/1000) = 7,715.51$ tCO₂e saved this year.

For glass:

- Current amount is 3909.58 tonnes
- 8.93 KgCO₂e is emitted per tonne of glass going to landfill.
- 21.32 KgCO₂e is emitted per tonne of glass being recycled.
- 670 KGCO₂e is emitted per tonne of raw material produced.
- $(3909.58/1000) * (670+8.93-21.32) = 2,570.98$ tCO₂e saved this year.

For Food Waste:

- Current amount is 6425.47 tonnes
- 626.91 KgCO₂e is emitted per tonne of food waste going to landfill.
- 21.32 KgCO₂e is emitted per tonne of food waste being recycled.
- 680 KGCO₂e is emitted per tonne of raw material produced on average in Europe.
- $(680+626.91-21.32) * (6425.47/1000) = 8,260.52$ tCO₂e saved this year

For Green Waste:

- Current amount is 13247.61 tonnes
- 578.99 KgCO₂e is emitted per tonne of green waste going to landfill.
- 21.32 KgCO₂e is emitted per tonne of green waste being recycled.
- As this is garden waste there is no raw material to substitute for.
- $(13247.61 /1000) * (578.99-21.32)= 7,387.79$ tCO₂e saved this year

For Wood:

- Current amount is 3021.99 tonnes
- 828.07 KgCO₂e is emitted per tonne of wood going to landfill.
- 21.32 KgCO₂e is emitted per tonne of wood being recycled.
- 0 KGCO₂e is emitted per tonne of raw material produced due to sequestration in growing trees via sustainable practices.
- $(3021.99 / 1000) * (828.07 - 21.32) = 2,437.99$ tCO₂e saved this year

For Scrap metal:

- Current amount is 944.1 tonnes
- 8.934 KgCO₂e is emitted per tonne of scrap metal going to landfill.
- 21.32 KgCO₂e is emitted per tonne of scrap metal being recycled.
- 1,900 KGCO₂e is emitted per tonne of raw material produced (steel used).
- $(944.1 / 1000) * (8.934 + 1900 - 21.32) = 1,783$ tCO₂e saved this year

For Others:

- Current amount is 2797.6 tonnes
- 423.37 KgCO₂e is emitted per tonne of other waste going to landfill.
- 21.32 KgCO₂e is emitted per tonne of wood being recycled.
- 1,622.57 KGCO₂e is emitted per tonne of raw material produced (average of others as no official figures available).
- $(2797.6 / 1000) * (423.37 + 1622.57 - 21.32) = 5,664.08$ tCO₂e saved this year

Therefore a total of 47,908.54 tCO₂e saved this year, which is 0.67 tCO₂e per household (47,908.54/70,000)

Consumption emissions

Given the total amount of recycled waste is 38,852, this means per household an average of 0.55 tonnes of waste is being reused/recycled (38,852/70,000), against 0.46 tonnes of residual waste, with the majority going towards EfW (only 0.05 tonnes to landfill).

While it is impossible to calculate exactly which materials these will relate to, some of the more significant elements can be estimated to demonstrate the separate consumption emissions being produced from the disposal of each material. Therefore, within this household figure, it is estimated that 194.75 tCO₂e arises from residual waste and 11.7 tCO₂e arises from all the recyclables combined.

Figures for consumption emissions assuming the same composition of waste – 46% residual waste, 54% recyclables. The latter is then broken down into: 22% MDR, 10% glass, 8% wood, 2% scrap metal, 17% food waste, 34% green waste, 7% other.

- Residual: $0.46 * 423.37 = 194.75$
- MDR: $0.55 * 0.22 * 21.32 = 2.58$
- Glass: $0.55 * 0.1 * 21.32 = 1.17$

- Wood: $0.55*0.08*21.32= 0.94$
- Scrap Metal: $0.55*0.02*21.32= 0.23$
- Food Waste: $0.55*0.17*21.32= 1.99$
- Green Waste: $0.55*0.34*21.32= 3.97$
- Other: $0.55*0.07*21.32= 0.82$

Savings without life-cycle emissions:

- 38852 tonnes were recycled this year.
- If this amount had gone to landfill it would have produced $(423.37*38852)/1000= 16448.77$ tonnes
- By recycling this was reduced to $(21.32*38852)/1000= 828.32$ tonnes
- Therefore there has been a saving of $(16448.77-828.32)=15620.45$ tCO₂e

Energy from waste:

- 22770 tonnes of waste going to EfW
- National average of 557kWh/t generated per tonne of waste input in 2020¹
- This generates 12.68 gWh this year.

New Development

Target 32. From 2021, 100% council new development is built to carbon neutral standards

Action 32.1 All new council properties will be built to the highest efficiency standards from 2021

It is imperative that both new homes and non-residential in the council must be built to be low-carbon, energy and water efficient and climate resilient. Getting the design of the new homes right from the outset is vastly cheaper than forcing retrofit later. Government projections suggest that from 2025 at the latest, no new homes should be connected to the gas grid. They should instead be heated through low carbon sources, have ultra-high levels of energy efficiency alongside appropriate ventilation and, where possible, be timber-framed.

Building new homes to net-zero carbon standards would not generate carbon savings, however, it will prevent any additional emissions.

Engagement and Behavioural Change

This section of the action plan focuses on promoting and accelerating the shift to more sustainable behaviours amongst our residents, businesses, schools and community organisations and will feed into the carbon savings achieved elsewhere on this action plan, such as increased use of public transport, as well as reducing out of scope emissions from purchases of goods and services. The majority of the actions are therefore listed as 'Neutral' for their carbon savings.

