



GROUNDWORK REPORT



European Union

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Working from Home - The Carbon Emissions Reporting Impacts

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Effects of the initial lockdown

The initial lockdown in early 2020 saw significant decreases in NO₂ pollution across European Capitals with the huge reduction in vehicle movements ¹ (Figure 1).

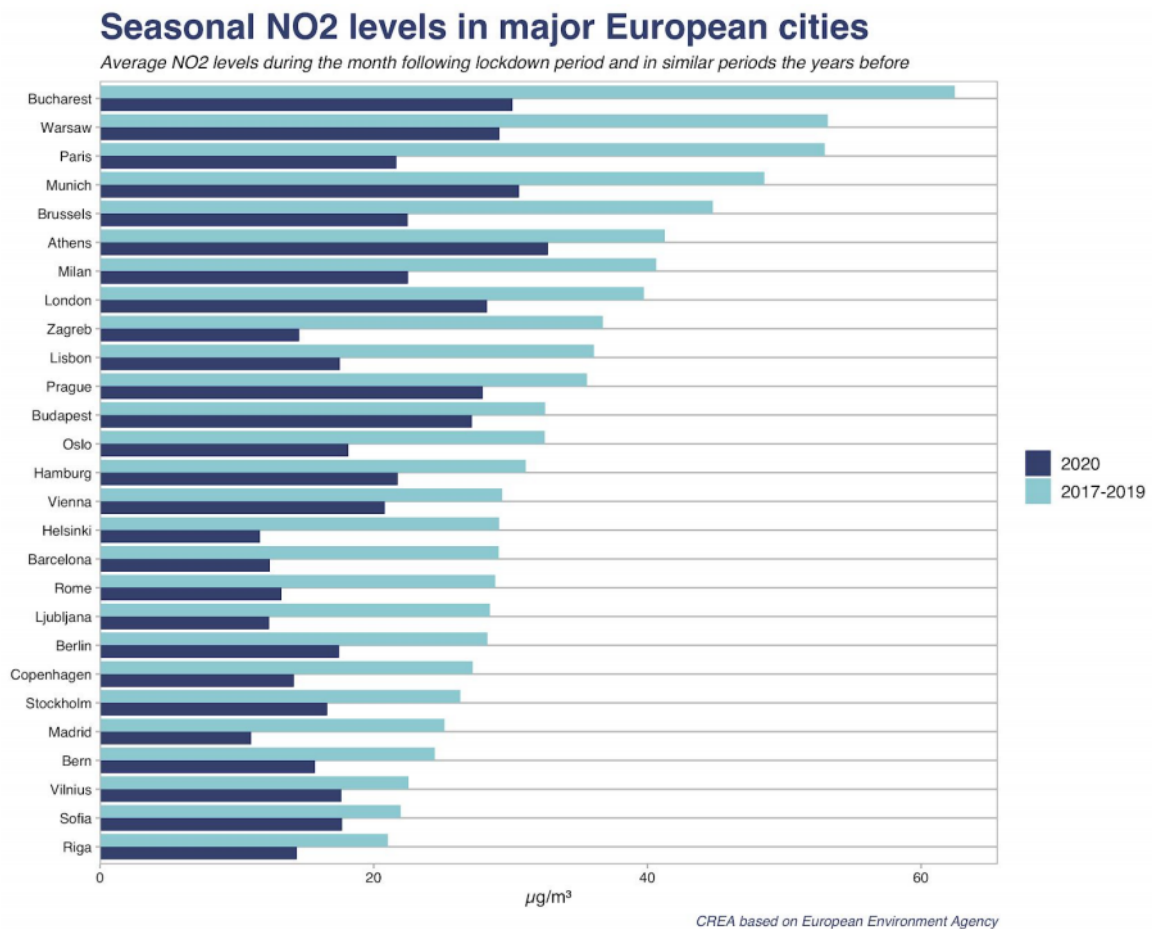


Figure 1: Average NO₂ levels during the month following lockdown period and in similar periods the years before.

¹ [CREA Air Pollution Returns to European capitals.](#)

Commuting, Social Travel and Workplace Re-Opening

As lockdown was eased this has rebounded unfortunately with the return of fossil fuelled transport (Figure 2).²

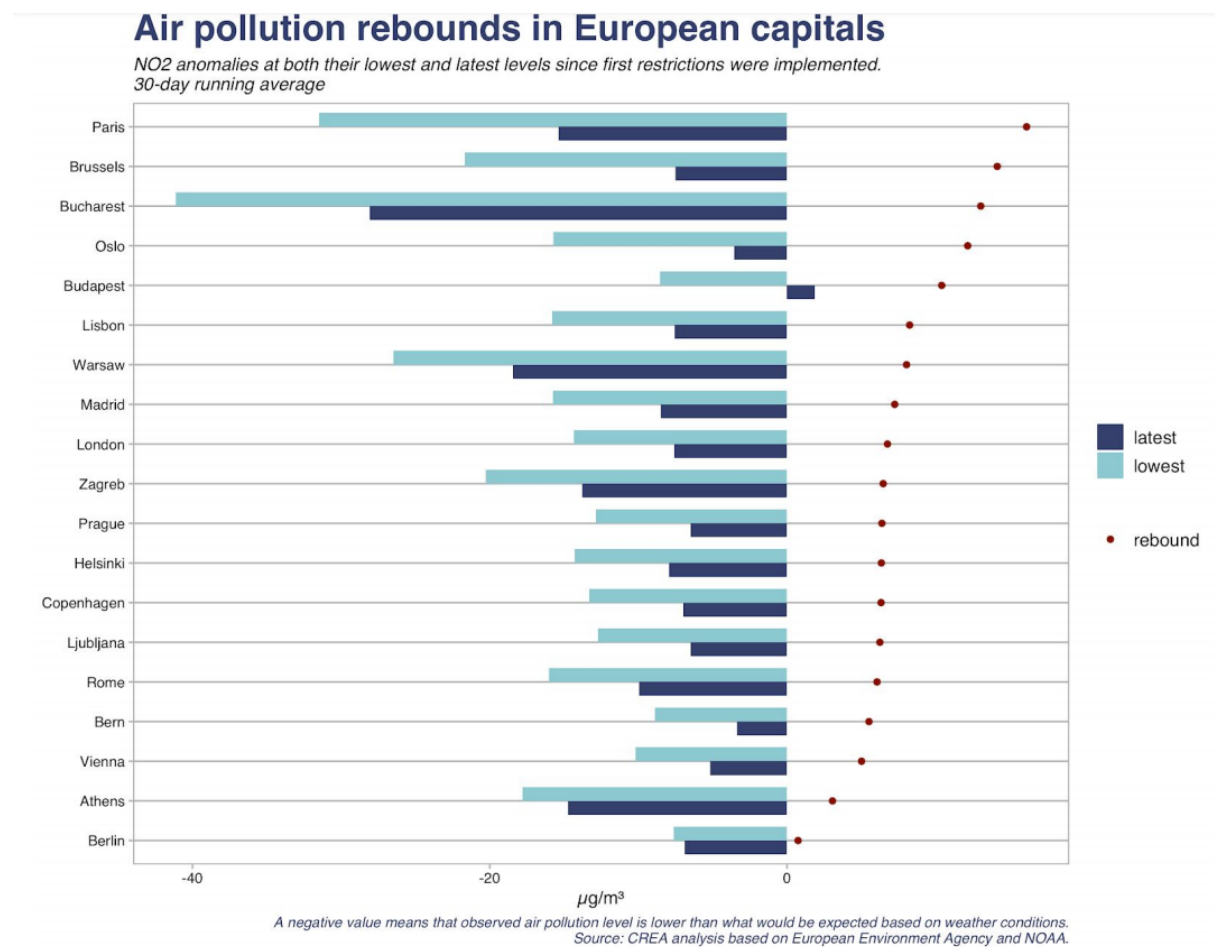


Figure 2: Air pollution rebounds in European capitals since the easing of lockdowns.

This data, published in June 2020, shows that cities were still benefiting from lower, weather corrected, NO₂ levels than would be expected but that it is converging on pre-CV19 levels.

² [CREA Air Pollution Returns to European capitals.](#)

Homeworking

Homeworking had been on a slow and gradual rise even before lockdown³ but rose suddenly when the first UK lockdown was initiated. This was most dramatic amongst the better qualified and higher skilled workforces.

Initial reports of the negative mental health impacts of working from home were understood to have eased for some as workers became accustomed to the new normal and some restrictions on social and work movements were lifted or eased over the summer.

Employers were obviously concerned about productivity falls while staff were not being overseen but research appears to indicate that there has been little impact overall, with 40.9% of homeworkers reporting in June 2020 that they were able to complete as much work as they were 6 months earlier, 28.9% reported higher productivity and 30.2% lower.

Added to this almost 50% of these workers wanted to continue working from home after restrictions were lifted.

Possible benefits include:

- Increased flexibility
- Few interruptions

There are obviously many factors to be considered:

- Increased isolation
- Home office costs
- Risk of overworking
- Risk to productivity
- Distractions at home
- Workplace disconnects
- Disproportionate work-life balance
- Less face to face time

This situation may have changed following the further lockdowns and higher restrictions experienced at the end of 2020 and start of 2021. These have led to greatly extended periods of homeworking and home schooling which may have impacted on opinions.

Long Term Impacts on Workplace Footprint Reporting

As the lockdown has developed employers are considering the longer-term arrangements for allowing workers back in to previously empty offices. This may mean opening offices for reduced staff numbers.

³ HOMEWORKING IN THE UK: [Before And During The 2020 Lockdown](#)

Depending on the nature of the existing offices this could mean reducing the total space required but, in many cases, in order to maintain social distancing, it may require the same space for fewer employees.

Home working employees will be adding to the wider carbon footprint of the operation while consuming heat, light and power at home, but this is likely to be outside of the scope of most organisations' existing energy monitoring and reporting procedures.

Businesses that were temporarily closed down or on reduced hours during early lockdowns may be reporting a reduced footprint associated with their premises. While other businesses may have introduced shifts to spread out production over longer hours to separate distinct teams of employees, thereby increasing the heat, light and power demand for a given level of productivity. Other workplaces may continue to be heated and lit for irregular, short term, staff attendance and a focus on increased levels of ventilation may also lead to higher space heating demands.

It has been reported, for example, that within the construction sector there has been an increase in business mileage due to the social distancing requirements halting previous vehicle sharing arrangements.

Carbon Reporting Protocols

There was no clear guidance at the time of writing this report from the UK government, Defra or the Greenhouse Gas Protocol on how businesses should report carbon emissions for exceptional years such as 2020 will undoubtedly be.

This report has examined the measures an organisation may wish to take to incorporate the impacts of a large workforce that is working from home for extended periods.

The Work from Home Scenarios

In order to include the impact of staff working from home it is necessary to consider the various scenarios that may apply to your workforce.

Dr Wendy Buckley of Carbon Footprint outlines three scenarios⁴:

1. Lone Home Worker – a staff member working alone in a house that is normally unoccupied during the day.
2. Home Worker with other, non-working, occupants – the house is normally occupied with family, children etc.
3. Office Based Worker – able to attend the office as normal.

The 4th scenario that may become more prevalent as the situation matures is the worker that is able to attend an office or place of work as normal but continues to work from home part of the week. This may be as part of a social distancing policy to rotate staff office hours for instance.

The key aspects for consideration in any business' carbon reporting would appear to be:

- a. Additional heat, light and power (HLP) emissions from the worker's home due to extra occupancy hours.
- b. Duplication of HLP if office is maintained while workers are away.
- c. Additional HLP consumption per worker if offices are operated with reduced staff.
- d. Reductions in commuting mileage when working from home.
- e. Increases in business travel and commuting due to reduced car sharing and avoidance of public transport.

Scenario 1. Lone Home Worker.

Occupying a house that is normally empty during the day will obviously entail a large increase in heating, lighting and power use. This extends over and above the home office space to include kettle, oven and hot water use.

All estimates of carbon emissions use the Defra 2020 conversion factors.

Heat and hot water

Dr Buckley assumes a house uses approximately 12,400 kWh of gas for hot water and heating per year. A worker being at home would add an estimated 8hrs per day which could increase that consumption by 25%.

Additional heating kWh =	$12,400 \times 25\% =$	3,100kWh per year
Scope 1 emissions =	$3,100 \times 0.18387 / 1000 =$	0.57 tCO₂e per year

Two home workers would share this impact equally.

⁴ Dr Wendy Buckley [Carbon Footprint of Working from Home.](#)

Power

Assuming a worker has a PC or laptop and monitor consuming 100w and a 20w light the electrical consumption for 8 hours per day, for 5 days a week and 45 weeks of the year would be:

$$\begin{aligned}\text{Electrical consumption} &= (100+20)*8*5*45 = & 216\text{kWh per year} \\ \text{Scope 2 emissions} &= 216*0.23314/1000 = & 0.05 \text{ tCO}_2\text{e per year}\end{aligned}$$

In addition to this allowing for 5 cups of tea/coffee would generate 0.01 tCO₂e per year, making 0.06 tCO₂e.

This is estimated to be rounded up to **0.1tCO₂e** to account for use of other lights, refrigeration, TV at lunchtime etc.

The total annual emissions for the lone home worker are estimated to be **0.67 tCO₂e**.

Commuting

The full-time home worker is not generating any commuting carbon emission.

Scenario 2. Home Worker with Other, None Working, Occupants.

It has been assumed that there will be no change to the heating of the house with the addition of the home worker so the only additional impact will be the electricity uplift of **0.1tCO₂e**. As a full-time home worker, there are no commuting carbon emissions to consider.

Scenario 3. Office Based Worker.

The office-based worker is assumed to be sharing demand for heating, lighting, electricity, beverages, cooking and sundry items and generates **0.13 tCO₂e** per person per year within the office. The report does not detail where this benchmark data is sourced.

Commuting

Unlike the home worker, the office worker is generating carbon emissions by commuting.

Assuming a 10 mile a day round trip in an average diesel car this equates to $10*(0.27108/1000)*5*45 = \mathbf{0.61 \text{ tCO}_2\text{e}}$ per year

This makes total yearly emissions of **0.74 tCO₂e** for the office worker. Figure 3 illustrates and compares Scenarios 1, 2 and 3.

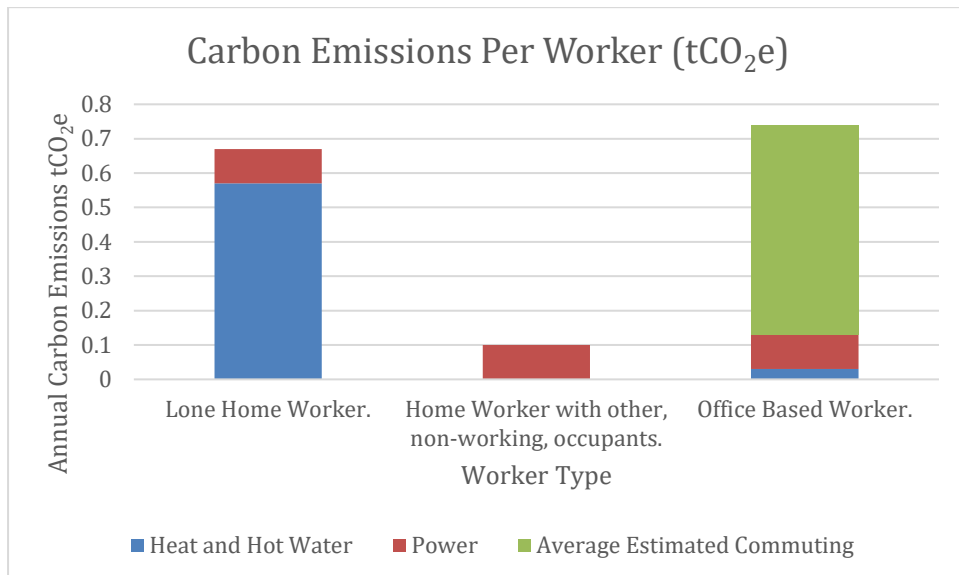


Figure 3: Carbon Emissions Per Worker According to Carbon Footprint's Estimated Data.

The commute can vary for each individual staff member due to the distance travelled each day, whether it is by private car, cycle or public transport and whether car sharing is carried out, which can make it difficult to calculate for a large organisation.

A large number of staff sharing an office space may reduce the consumption per person but in many cases the emissions from the commute may be far more significant.

It may be feasible within some organisations to survey different staff sectors to estimate average commuting methods and mileage in order to get a more accurate figure.

It is understood that the East of England Co-operative survey their staff every six months in order to assess the methods of transport and approximate distances travelled. This can then feed into carbon reporting and also direct behaviour change efforts to meet reduction objectives.

Calculations of employee's commuting emissions may be fuel-based, distance-based or average-data-based as best suits the business depending the consistency and the availability of data.⁵

Alternative estimates of emissions from the various worker scenarios vary, with a WSP report suggesting that the actual emissions resulting from a lone worker based at home

⁵ Greenhouse Gas Protocol: Technical Guidance for Calculating Scope 3 Emissions.

https://www.google.com/search?q=Category+7%3A+Employee+Commuting&rlz=1C1GCEU_enGB854GB854&oq=Category+7%3A+Employee+Commuting&aqs=chrome..69i57.1010j0j15&sourceid=chrome&ie=UTF-8

would actually generate higher emissions than an office worker due to the loss of co-working energy efficiencies of scale (Figure 4).⁶

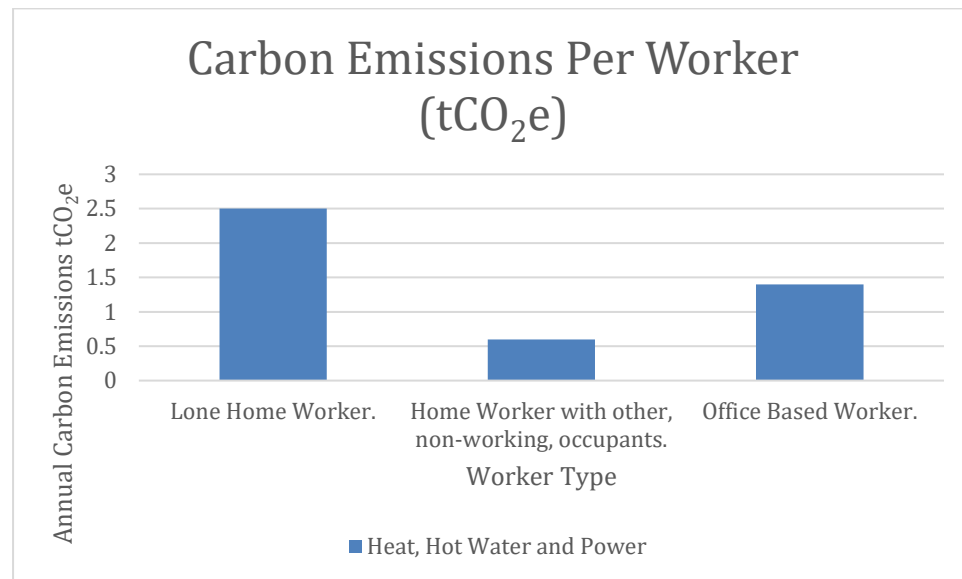


Figure 4: Estimated Emissions for Each Worker Type from the WSP report Office vs Home Working: How We Can Save Our Carbon Footprint.

In contrast to the Carbon Footprint methodology, the WSP report is based on CIBSE ECON 19⁷ benchmark data for a type 3 air-conditioned office operating good practice compared to UK Power average home energy benchmark data⁸ to calculate the comparison between the three scenarios. Commuting data is taken from the Department for Transport Commuting Trends in England 1988-2015 report.⁹

This reports a broadly similar carbon emission pattern across the three scenarios however prediction for a lone home worker is considerably higher.

The UK Energy Research Centre produced a paper in July 2020 collating the findings of 39 studies across US, Europe, Asia and the Middle East in to the impacts of teleworking on carbon emissions.¹⁰

⁶ WSP. Office vs Home Working: How We Can Save Our Carbon Footprint. <https://www.wsp.com/en-GB/insights/office-vs-home-working-how-we-can-save-our-carbon-footprint>

⁷ ECG19 Energy Use in Offices. [http://www.cibse.org/getmedia/7fb5616f-1ed7-4854-bf72-2dae1d8bde62/ECG19-Energy-Use-in-Offices-\(formerly-ECON19](http://www.cibse.org/getmedia/7fb5616f-1ed7-4854-bf72-2dae1d8bde62/ECG19-Energy-Use-in-Offices-(formerly-ECON19)

⁸ UK Power Home Energy. https://www.ukpower.co.uk/home_energy/average-energy-bill

⁹ Department for Transport Commuting Trends in England 1988-2015. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/657839/commuting-in-england-1988-2015.pdf

¹⁰ UK Energy Research Centre. Lockdown lifestyle: does working from home reduce carbon emissions? <https://ukerc.ac.uk/news/lockdown-lifestyle-does-working-from-home-reduce-carbon-emissions/>

It was found that the large majority, 26 reports, concluded that carbon emissions reduced with teleworking, three were neutral, five estimated an increased and five were unclear (Figure 5).

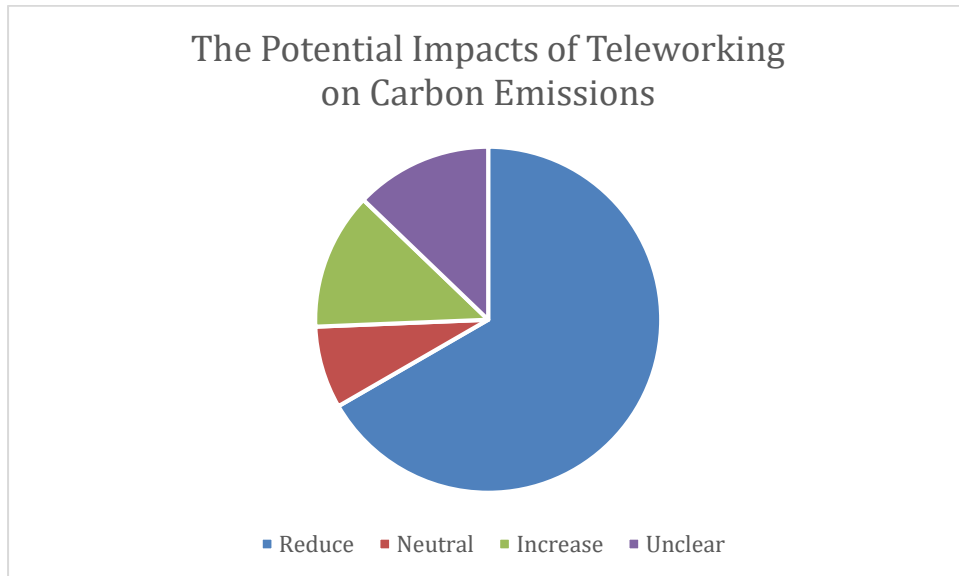


Figure 5: UK Energy Research Centre Research Findings of 39 Studies Conducted Across US, Europe, Asia and The Middle East in to the Impact of Teleworking on Carbon Emissions.

It should be noted that the methodology of each study included in the paper varied which may mean the carbon emission benefits may not be this conclusive.

Conclusion

In 2014 The Carbon Trust reported that over 40% of UK jobs could be carried out at home however only 35% of companies had procedures in place to do so. If an additional 4 million worked from home 3 million tCO₂e could be saved each year.¹¹

It is clear that there are several factors impacting the overall carbon footprint of each staff member. The difference in carbon emissions between a single worker commuting to the office or working from a normal unoccupied home may be small depending on the specifics of the situation. The length of the commute being the largest factor.

As would be expected, a worker staying at a home that is usually occupied will potentially add very little to the normal emissions of the household.

The other significant aspect that would need to be addressed in the carbon reporting calculations is whether the official office remains open while staff are working from home, whether other staff are working there occasionally, and whether the heating and lighting is on throughout the whole building.

The think tank, ECIU, predicts that boiler use will increase this winter by 56% due to the concurrent heating of workplaces and homes.¹²

For organisations wishing to reduce their carbon footprints, encouraging working from home will only achieve significant reductions if office space can be proportionally reduced in line.

Large organisations are considering reopening offices on a rotational basis¹³, while others are looking to rationalise office space to accommodate the desires of some staff and presumably to also reduce overheads.¹⁴

Other, longer term, considerations include whether options for working from home will encourage staff to be located further away from the base office, with occasional visits to the office generating higher commute emissions that negate the savings realised while working from home.

Workplace Welfare

The welfare of the worker should also be considered during these imposed periods of working from home;

¹¹ Carbon Trust: [Homeworking: helping businesses cut costs and reduce their carbon footprint.](#)

¹² ECIU [https://eciu.net/ Stay-home winter to lead to surge in boiler NOx emissions](https://eciu.net/Stay-home-winter-to-lead-to-surge-in-boiler-NOx-emissions)

¹³ <https://www.theguardian.com/business/2020/sep/09/goldman-sachs-return-to-work-coronavirus-office>

¹⁴ <https://www.bbc.co.uk/news/business-53968213>

- Negative impacts on mental health through isolation¹⁵
- Family stresses and difficulties¹⁶
- Allowances for additional home office costs i.e. equipment purchases, desks and chairs¹⁷
- Allowances for the increased home energy costs
- Whether all workers benefitted equally through the reduction in commuting
- Provision of facilities for workers not wishing to work from home

Annual Carbon Reporting

There has been no definitive precedence set regarding how businesses should address these issues in their annual carbon reporting.

The main impacts brought about by the current pandemic may include:

- Significantly reduced Scope 1 and Scope 2 emissions due to part or full closure
- Increased emissions relating to HLP at workers homes (potentially a Scope 3 emission)
- Reduction in a reporting company's Scope 3 emissions relating to employee's Scope 1 and Scope 2 commuting emissions.

These aspects should be referred to in any GHG reporting a business does in the conventional, transparent manner in order to explain any significant deviations in the emissions within the current scope of the report and also to address whether the scope should be expanded to incorporate new significant emissions associated with the changes in operating procedures or the structure of an organisation.

Groundwork is able to support organisations to scope and identify their carbon footprints and to develop strategies towards emissions reductions or net-zero objectives. Furthermore, we can help to review the carbon impacts of workforces working from home.

Suffolk Climate Emergency Plan

Within the Transport section of the Suffolk Climate Emergency Plan, the local authority declares a specific goal of reducing car use through increased home working and Action #5 specifies 'engagement with businesses about allowing their workforce to continue working from home post Covid-19' by 2022.

As we have seen there are many factors that affect the potential emission savings, or otherwise, from working from home.

¹⁵ MIND. Coronavirus: supporting yourself and your team.

<https://www.mind.org.uk/workplace/coronavirus-and-work/tips-for-supporting-yourself-and-your-team/>

¹⁶ NHS UK: 7 simple tips to tackle working from home. <https://www.nhs.uk/oneyou/every-mind-matters/7-simple-tips-to-tackle-working-from-home/>

¹⁷ HSE. Protect home workers. <https://www.hse.gov.uk/toolbox/workers/home.htm>

In order to quantify this goal, it is necessary to consider the number of employees commuting each day, the method and distance of travel and the number of commutes that could be avoided, along with the home working situation.

The Suffolk Ltd 2019 report estimates that the largest 100 privately owned companies in Suffolk employ 35,964 staff.¹⁸ Of these employees it is estimated that 60% commute to work alone by car, travelling an average of 10 miles each way.^{19 20}

A full-time home worker, working in a home that is normally unoccupied, and who would have otherwise commuted 10 miles each way by car, alone, is estimated to produce an average emission saving of 0.55tCO₂e per year.

Assuming that 25% of the employees from these 100 companies, who would normally commute alone by car, could work from home 2 days per week (40% of the working year) the potential emissions savings could be in the region of 1,187tCO₂e per year.

There may be co-benefits associated with these changes to working patterns and behaviours, such as reduced road congestion and reduced NO_x emissions, however, as outlined in this report, there may also be inadvertent emissions increases elsewhere.

¹⁸ Suffolk Ltd 2019: <https://www.grantthornton.co.uk/globalassets/1.-member-firms/united-kingdom/pdf/search/suffolk-limited-2019.pdf>

¹⁹ State of Suffolk 2019: How we Travel . <https://www.healthysuffolk.org.uk/jsna/state-of-suffolk-report/sos19-how-we-travel>

²⁰ Department for Transport. Commuting trends in England 1988-2015. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/877039/commuting-in-england-1988-2015.pdf