sb-energy

AI for good? But at what cost?

Environmental impact of using AI tools in a charity setting

citizens advice County Durham

Key findings

- Using digital tools, including AI tools like Co-Pilot and ChatGPT, **has an environmental impact,** however in media coverage of AI development, this impact **may be overstated**
- Detailed **sources of data** about energy and water use of AI data centres **are limited** but we can make **sensible assumptions** based on available data
- **Environmental impact,** particularly CO_2 emissions and water use linked to utilising AI tools in the UK, **could be considered small** relative to local organisational impact with emissions a similar order of magnitude to those caused by utilisation of existing digital services (Office365)
- Using tools from **providers with clearly stated environmental aims** can help minimise wider environmental impact of AI training and inference, as well as data centre construction and critical mineral mining
- Widespread adoption of AI tools within Citizens Advice County Durham would contribute to **a small increase** in the organisation's **scope 3 emissions**
- Existing emissions to heat and power sites within the organisation are **multiple times more than those prompted by use of AI**

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Executive summary

Artificial Intelligence (AI) has the potential to shape how we carry out day to day tasks, and could enhance the services charities provide across the Country. However, concerns around the environmental impact of using AI tools make organisations wary of adopting those tools, because of the risk of contributing to issues linked to water shortage, waste generation and climate change.

This study sets out to estimate the impact of using AI for Citizens Advice County Durham (CACD), and is intended to support future projects that CACD undertake. It has been commissioned because CACD have already begun using AI tools including trialling the use of AI using *MS-Co-Pilot* to support debt advisors, and developing a chat function to offer initial online debt advice in an Automated Debt Advice Assistant (ADAA). Both these tools will be utilising models based on *ChatGPT*.

It has been stated that a single ChatGPT query takes approximately 0.0034 kWh of electricity. A query carried out in County Durham is likely to be processed by a data-centre in the UK or Europe. As such, we can assume the CO_2 intensity of electricity used to answer the query to be average in these locations. In the UK, in 2026, a kWh of CO_2 can be assumed to have emissions, on average, of 177gCO_2. So, a single ChatGPT query would have emissions of less than 1 gCO_2. It should also be noted that if a data centre is powered in the UK, with government ambition to achieve clean power by 2030, the emissions of a ChatGPT query are likely to drop significantly in the medium term.

Limited data
Data around energy and water use, areas of significant environmental impact, for AI data centres is limited. A combination of a lack of standardised methods of measuring or reporting, and data being commercially sensitive for many tech companies, limits the amount of data available for analysis. Several studies have made sensible assumptions to understand environmental impact that are detailed in this study.

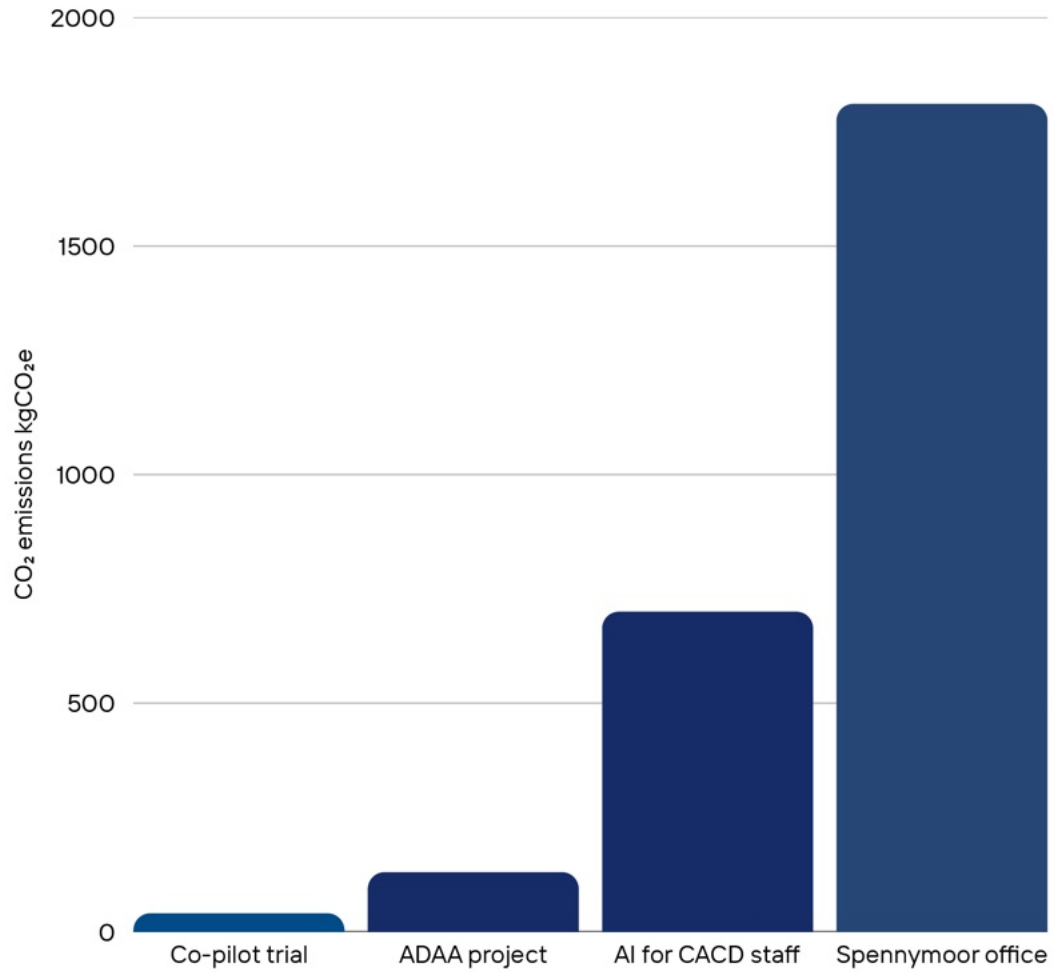
Similarly, data centres in the UK and Europe tend to use a modest amount of water, if any, to cool servers. More than half have waterless cooling systems, about 2/3rds use less than a typical leisure centre each year. A ChatGPT query therefore is considered to be responsible for a small amount of water use, with future data centres moving towards lower impact cooling systems.

Environmental impact of AI

The current Co-Pilot trial and ADAA project are estimated to emit between 50-150 $kgCO_2$ each year, assuming Co-Pilot is used by 24 staff and volunteers, 25 times a day, and that the ADAA project has 20 individual sessions with members of the public seeking support, with 10 interactions per session. If 120 staff were using Co-Pilot 25 times a day, emissions could be in the region of 650-700 $kgCO_2e$ per year.

Billing data provided by CACD for their office in Spennymoor suggests that the site uses 7818 kWh of electricity and 2335 kWh of gas in a 12 month period. Therefore this office is estimated to have emissions to heat and power the building of 1,811 $kgCO_2$, over 10x the emissions of the Co-Pilot and ADAA trial projects, and 3x the emissions if every staff member at CACD were using Co-Pilot or ChatGPT 25 times a day.

It is clear that there is an environmental impact to using AI tools to support services provided by CACD, however the impact is significantly lower than the CACD office space in Spennymoor.



Similarly, as a rural service, staff and volunteers at CACD use personal cars to travel around the County. In 2025, the organisation drove 36,547 miles, assuming these miles were undertaken in average cars, this would have had associated emissions of 10.2 tCO_2, over 5x the emissions associated with the Spennymoor Office, and 15x the estimate of environmental impact if all staff at CACD used AI tools.

Although development and operation of AI tools around the world will have a meaningful environmental impact, the impact that use of tools by Citizens Advice County Durham to support debt advice would be a negligible part of that impact. Similarly, the impact is small when compared to the organisational emissions within County Durham. It is suggested that the good that could be delivered in the use of AI tools within a charity context is of greater benefit than the small environmental impact they may have.

It should be noted that this report does not consider the wider ethical concerns that are discussed around the use of AI, including risk of bias, lack of transparency, cyber security, and reduction of human roles within decision making and responsibility.

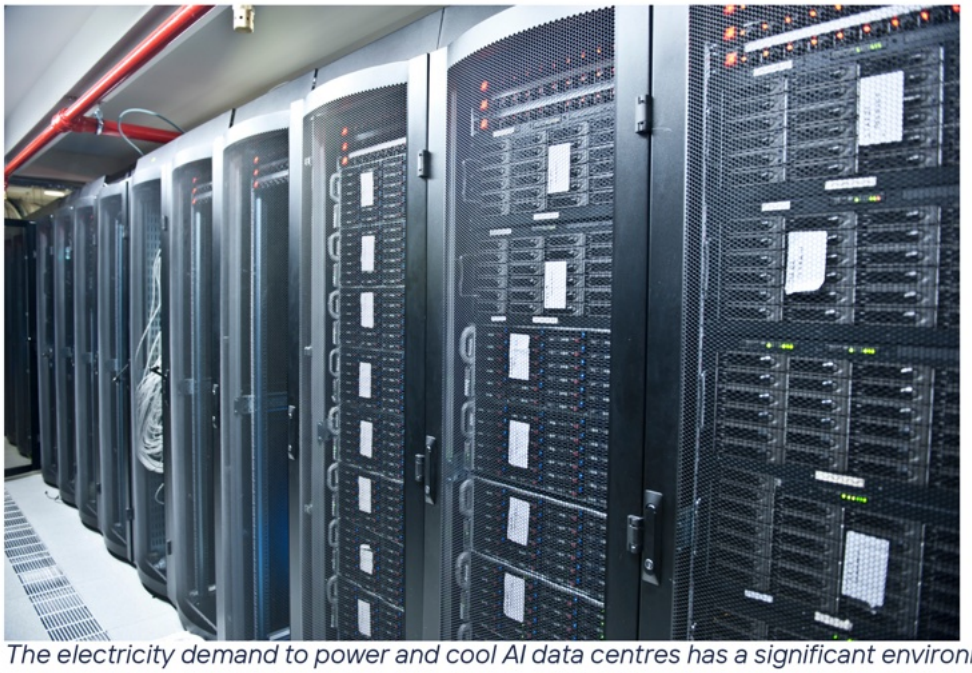
Background

Conversations around the use of Artificial Intelligence have become inseparable with concerns about environmental impact of using tools in day to day life. It has become common to hear someone talk about how useful an AI tool has been for them before the reply comes *'but what about the environmental impact?'*

AI has the potential to offer significant benefits in providing services for residents of County Durham, with the potential for tools and learnings replicated across the country. However, AI's rapid pace of innovation, exponential growth and demand for resources have raised significant concerns about its potential negative impact on the environment.

How concerned should we be about the environmental impact of using AI tools to support day to day activities? And should this concern limit the use of AI to enhance the services that charities could provide?

This report reviews the latest literature published on the subject, considers a range of environmental impacts associated with data centre development and operation and puts potential use of AI for Citizens Advice County Durham (CACD) into context. This is intended as background data that would contribute to decision making and project development for CACD in the future.



The electricity demand to power and cool AI data centres has a significant environmental impact

Global Context

The issue of energy and water use of data centres, alongside the growth of data centres has been covered extensively in the media, although stories about data centre growth and the associated environmental impact may have been published without context of the scale of the impact. Organisations developing AI tools and data centres, often private, commercially sensitive organisations, do not tend share data on growth, energy and water consumption transparently. The lack of data and peer reviewed research into the subject has resulted in *'the proliferation of media statistics, many of which lack credible backing'* (according to an Issues note published by the United Nations Environment program). This includes data shared that may appear to point to a larger problem, but not in context.

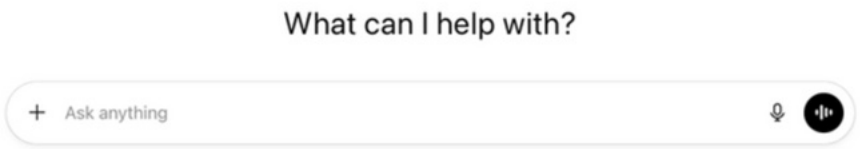
Considering the lack of published data, the discussion around the environmental impact of the growth and use of AI tools relies on assumptions that can vary between reports.

The International Energy Agency estimates that all data centres, including AI development and utilisation, used approximately 415 TWh of electricity in 2022, or 2% of global electricity demand. Building on this, the IEA anticipates that data centre demand for electricity could double by 2030. This estimate sets out a dramatic rise in electricity demand for data centres, however in this scenario, data centres are expected to become ~2.6% of global electricity demand by 2030. Increases in data centre demand, when considered in global context, appear to be less significant than feared in some reporting.

Considering the issue from a different perspective, one researcher set out to quantify the increase in energy demand linked to AI tools by estimating how much energy would be consumed by servers that have been manufactured and sold in recent years. The estimate in this study suggested that if all the servers delivered to data centres in 2023 were running at full capacity the increase in electricity demand would be 5-10 TWh, a small fraction of existing data centre demand.

Similarly, estimates for energy use for queries to large language models, like ChatGPT or the AI Overview that Google now provides alongside its search function, suggest that these queries use 10 times as much energy as a standard google search. If this was the case, it is estimated that Google's annual electricity demand would increase from 18 to 29 TWh, a significant increase, but small compared to existing total data centre demand.

In a blog in summer 2025, Sam Altman, CEO of OpenAI developer of ChatGPT suggested that a single ChatGPT query would use 0.0034 kWh of electricity. If this figure was accurate, it could be used to estimate the environment impact of the increase in energy demand linked to AI use. Similarly, it is estimated that streaming Netflix for 1 hour would use 0.077 kWh of electricity, 20x more than a ChatGPT query.



A query through ChatGPT is likely to cause a small amount of electricity demand

Many of the estimates for energy use available online seem implausibly low given the scale of media coverage about this issue. Or, it may be the case that lack of context in the coverage of AI development may have led to exaggeration of energy demand. It should also be noted that a significant proportion of AI and associated data centre development is happening in a limited number of geographies, and notably the USA, whose influence on English speaking media may have biased media coverage in the UK.

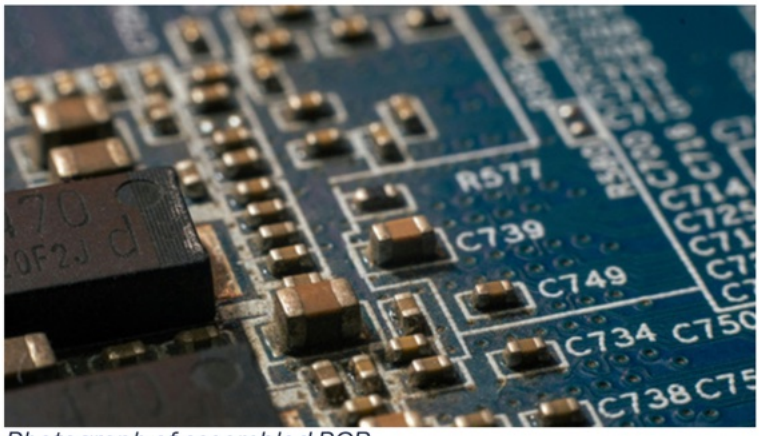
Much of the statistics in data centre growth and modelling about the future is uncertain, but in the global energy context, although still significant, data centre growth appears to be a small part of growth in electricity demand over the next 5-10 years.

Wider environmental impact

Further to the energy demand for AI training and operation, there are further environmental impacts in construction of data centres, mining of critical materials that are used in chips, manufacturing of chips and servers, water use for data centre cooling, and upgrade to electrical infrastructure required to facilitate data centre usage.

Mining, construction and manufacture

The equipment used in modern IT systems and data centres, including equipment used for AI tools, requires a range of minerals and metals. Whether this is in construction of new data centres and cooling systems, the semiconductors and microelectronics used in servers or the construction of new power systems to help drive AI data centres. Many of these materials are known as critical minerals, and include materials like Boron, Silicon, Lithium, Gallium and Graphite.



Photograph of assembled PCB

Mining and processing these minerals significantly affects the environment, through high energy demand and associated emissions, risk of groundwater depletion, water and soil contamination, deforestation and soil erosion, that can contribute to biodiversity loss, land harm to human health.

There is also risk that growing demand for AI infrastructure risks putting AI tools in direct competition with other societal and environmental needs, such as the expansion of renewable energy infrastructure needed to mitigate climate change.

Much of the environmental risk of mining and manufacturing materials linked to AI development is upstream of AI data centres and companies that operate them. Coupled with a lack of transparency in this industry, details of impact are limited. However, some companies report their aim of increasing recycling rates of hardware, minimising the need for new materials. It is likely that much more emphasis on the impact of mining and processing critical minerals is needed to drive sustainability in this sector.

Water use

As much data centre growth has taken places in parts of the world that are hotter than the UK, water, that is used in the construction phase and for data centre cooling, is a precious resource that needs to be conserved. This includes parts of the world where chips used in AI servers are developed and manufactured that are also water stressed parts of the world. Over the last 5 years, drought in these areas has impacted on rates of manufacture of chips used in AI data centres, or considered from a different perspective, water demand in chip manufacture contributed to reducing water reserves in drought impacted countries.

Similarly, in data centres around the world, water is often used to help cool data centre processes. In August 2025, techUK published a report 'Understanding data centre water use in England'. This report summarised that 51% of surveyed data centre sites operated waterless cooling systems, reliant on air or refrigerant cooling, 64% of data centres used less than 10,000 m3 of water per year, less than a typical leisure centre and 89% of data centres measured water use or deploy systems that do not require water for cooling. This data indicates that, although potentially still a significant additional water demand and an issue that could be improved on, data centres can operate with low or zero water demands for cooling.

In an announcement in Autumn 2025, data centre developer, Equinix, announced a £3.9bn investment in a new data centre campus in Hertfordshire. As part of press coverage about the investment, Equinix stated that the development would be dry-cooled with no water used for cooling, meaning that the site would have comparable water use to conventional office buildings.

Data centre cooling system

Although excessive water use is a potential risk, particularly in water-stressed parts of the world where planning rules should look to minimise water usage in data centre development, many modern data centres will have low water demand.

In the UK, data centre design and development considers water use a key sustainability indicator.

Electrical infrastructure

Much of the coverage about AI data centre construction is about the increase in power required for new data centres, and new connections required at a data centre locations. These new connections may require the reinforcement of local and national grid infrastructure adding cost and complication to existing infrastructure.

In the UK, the national grid is undergoing a significant overhaul to upgrade ageing grid for modern requirements, as well as future proofing the grid to take advantage of distributed renewable energy and increase in demand associated with low emissions heating and transport. Part of this upgrade is taking demand for new data centres into account. It could therefore be concluded that electrical infrastructure upgrade would be happening without additional data centre demand, or that additional data centre demand is helping to invest in grid upgrades that benefit us all.

Separating the impact of grid upgrades and attributing this impact to data centre growth is nuanced. However, grid upgrades are likely to impact the environment positively as society moves towards a low emissions future with AI data centre demand for electricity part of that low emissions future.

Additional electrical distribution may be required for AI data centre development

One commentator has suggested that AI development could be a key part in accelerating efficiency of the energy transition as AI tools assist in design and placement of wind turbines and distribution networks, as well as acting as a key tool in matching variable supply with demand.

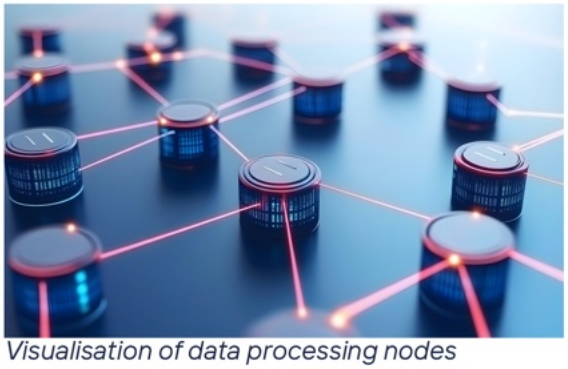
Where are queries processed?

Although coverage around data centre development tends to have a global focus, a query through ChatGPT (and many other AI tools) in the UK, could be dealt with by a range of data centres in the UK or Europe, before relying on global infrastructure. The location a query is made and dealt with does have an impact on the environmental impact of an AI query. With CO_2 intensity of electricity, and abundance of water supply, varying from Country to Country.

Although we cannot guarantee where a query would be processed, we could assume some location based routing would take place for AI interactions in the UK. For example, when a user in the North East of England makes a query using a paid ChatGPT or Co-Pilot account, the request will be routed through cloud infrastructure and directed to whichever data centre cluster is available, including data centres in the UK. Some ChatGPT subscriptions have data residency rules that keep all processing within UK/EU data-centres. Some subscriptions come without a regional guarantee, meaning processing could occur in UK, EU or USA data-centres depending on demand and model availability. It is likely that a data centre based in the USA would have higher emissions than one in the UK or Europe.

For UK-based users, the most common processing locations are London, Cardiff and Western European cloud regions. However, the latest models may sometimes be served from US processing clusters.

Because carbon intensity varies significantly between regions, the environmental impact of an AI query depends in part on where the inference actually happens. UK data-centres typically operate with moderate carbon intensity (150–220 gCO_2/kWh), while some European and US regions may be higher. OpenAI is also developing new European infrastructure which may significantly lower the carbon footprint of future queries.



Visualisation of data processing nodes

AI company environmental statements

Doing business sustainably is an important aim for many tech companies, including those developing and hosting AI tools

- Microsoft has a stated commitment to be Carbon Negative and water positive by 2030, and to have dealt with all its historical emissions by 2050. In 2024, Microsoft entered into contracts to receive 19 GW of new renewable energy (19 GW would be about 35-40% of UK electricity demand in 2025). These are meaningful commitments that will contribute to minimising the environmental impact of AI
- Although Open AI (developers of tools like ChatGPT) does not have clear public statements linked to emissions reduction, water use or sustainability, much of its services are performed using Azure infrastructure, that comes under Microsoft's sustainability ambition
- CACD utilise Amazon Web Services as part of their digital infrastructure, AWS has a commitment to achieve Net Zero carbon by 2040, and being water positive by 2030, this includes investment in low carbon and renewable energy sources around the world as well as focusing on continuous improvement of efficiency of their sites
- Although not necessarily part of AI tools in the trials underway, Google forms a key part of our digital experience. Google has stated that in 2024, 100% of its electricity demand was matched with renewable energy purchases, 66% of which was matched with local renewable generation in each hour of demand.

The impact of tech companies on the environment is set to continue for many years, however with clear targets, actions to deliver against those targets, and a level of monetary resources to support those actions, much of the environmental impact of AI tools could be minimised in the medium term.

CACD context

Citizens Advice County Durham (CACD) have begun developing AI tools for public facing advice services and debt advice staff and volunteers are trialling the use of AI tools to support with administration for normal services. If rolled out and used effectively, these tools could improve the services CACD provide and help disseminate debt advice to those in need.

Automated Debt Advice Assistant

The Automated Debt Advice Assistant is intended as an online tool that can offer basic debt advice to members of the public who are experiencing issues around debt, as well as gather relevant information to help streamline signposting from experienced debt advisors. The online tool, using ChatGPT, can help gather information, respond to basic queries relating to debt advice, and signpost next steps for an online user.

Co-pilot

16 staff at CACD and 8 volunteers from East Durham trust have been trialling the use of Co-pilot to support their debt advice services. Co-pilot assists with administrative tasks that a debt advisor would help a client with and could help streamline the services that debt advisors provide. Speeding up administration tasks and allowing for debt advisors to concentrate on providing high quality support to clients.

Before rolling out these tools to the public, or utilising them across the organisation, CACD hope to understand the environmental impact of the tools.

CO_2 Emissions of existing AI trial

If the ADAA tool were used **20 times per day** by members of the public, who had **10 interactions** on each visit, this could be assumed to be equivalent of 200 queries using ChatGPT. Using the estimate of each query using 0.0034 kWh of electricity, this means that the ADAA tool would use **0.68 kWh of electricity each day.** If we assume that the data centre powering the responses was in the UK and assume average emissions for grid electricity, 1 day of ADAA usage in County Durham would generate **0.12 kgCO_2.** Annually, emissions would be **approximately 44 kgCO_2**. The equivalent of driving a modern petrol car 219 miles.

Similarly, the use of co-pilot in the current trial, if all 24 members of the trail used co-pilot to assist with their normal work **25 times a day,** this could have electricity demand of 2.04 kWh, **CO_2 emissions of 132 kgCO_2 per year.**

If 120 staff and volunteers used co-pilot 25 times a day, this could have CO_2 emissions of 658 kgCO_2 per year.

If we assumed that one of those staff lived in a house of average energy consumption, the emissions of that home would be 3.8x emissions from use of co-pilot for 120 staff over the same year.

In a white paper in 2022, Microsoft estimate that utilisation of standard Office 365 services per license was responsible for 210 gCO_2 each month or 2.5 kgCO_2 per year, about 45% of the estimated emissions linked to use of Co-Pilot.

Context of CACD emissions

It is helpful to compare the estimated emissions of AI use with emissions of existing activities across the organisation, to help put emissions into context.

CACD has not carried out a detailed carbon foot-printing exercise, however data received as part of this project suggests that offices at Spennymoor and Seaham use approximately 9000 kWh of electricity and 2900 kWh of gas each year. This energy demand would have emissions associated with it of approximately 2.1 tCO_2 each year.

Understanding emissions at CACD helps put into context the impact of utilising AI tools for the organisation. At the high end of estimated CO_2 emissions for 120 staff and volunteers using an AI tool 25 times a day, emissions to heat and power offices at Spennymoor and Seaham are 3.2x higher than those associated with using AI tools.

Similarly, staff mileage at CACD for 2025 totalled 36,547.38 miles, if emissions associated with that mileage were assumed to be an 'average car' under GHG reporting conversion factors for this year (278 gCO_2 per mile) this would have a total emissions of 10,178 kgCO_2 per year.

The Spennymoor CACD office

If the other CACD sites are considered, as well as mileage claims for staff travelling around the county, it is likely that organisational emissions are multiple times higher than the risk of environmental impact posed by utilisation of AI tools.

GHG reporting - context
Within the Green House Gas reporting protocol, an organisation's emissions are separated into several groups or scopes, helping to standardise emissions reporting across different organisations. The scopes are split into

- Scope 1 - direct emissions mainly linked to fuel burnt (e.g. gas for heat in buildings, fuel for vehicular travel, and emissions from refrigerant use)
- Scope 2 - indirect emissions linked to energy purchased (for most organisations this is limited to electricity purchased)
- Scope 3 - indirect emissions linked to the good and services an organisation purchases (this could be linked to emissions created in collecting waste from an organisation, emissions from business travel, or another company's emissions that are provided services to the reporting organisation

Organisations tend to see scope 1 and 2 emissions as in their control, whereas scope 3 emissions are under their influence but not directly controllable.

In the summary of emissions in this report, those linked to CACD offices would be classed as scope 1 and 2 emissions, however emissions caused by use of AI tools would be classed as scope 3, emissions that have been provoked by use of the tool, but would form scope 1 or 2 emissions for another organisation (e.g. data centre operator).

Conclusion

The growth of AI tools around the world is coupled with increases in electricity demand to power AI data centres, risk of excessive water use, concerns about mining of materials and electronic waste. The increase in energy, water and material use all provide environmental risk that should be minimised as AI tools are adopted.

However, considering the local context and scale of increase in energy, water and material use compared to existing systems, ***the environmental impact of CACD's use of AI is considered small.*** With emissions associated with extensive usage in supporting CACD's activities a fraction of CACD's organisational emissions, and with excessive water use designed out of data centre development in modern data centre construction, it could be considered that environmental impact of using AI tools is overstated.

If environmental impact of an organisation is important, then considering the impact of burning fuel (natural gas, petrol or diesel) in heating buildings and fuelling vehicles as part of their activities should be a priority before limiting the potential of using AI tools.