Research and analysis

The carbon footprint of a GCSE

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Applies to England

Contents

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- PA Consulting Group is a professional services management consultancy that operates in the energy and utilities industry, among others. It is a member of the United Nations Global Compact, a non-binding pact to encourage organisations to adopt sustainable and socially responsible policy.
- Climate Partner is a consultancy specialising in climate action. It brings expertise on sustainability to help organisations to calculate and detail their carbon impact.

With thanks to

The following organisations participated in interviews, workshops and data collections to inform the review:

- Exam boards: Pearson (Edexcel), OCR, AQA and Eduqas
- Standards and Testing Agency (STA)
- Joint Council for Qualifications (JCQ)
- Department for Education (DfE)

Background

The Department for Education (DfE) has set out a Sustainability and climate change strategy for the education system. Within the strategy there is a specific commitment to develop a sustainable

assessment model. The UK government has committed to achieving net zero greenhouse gas emissions nationally by 2050, referenced in its NetZero Strategy: Build Back Greener.

Ofqual is the independent, expert regulator of qualifications and assessments for England. In its Corporate Plan 2022 to 2025, Ofqual committed to “exploring the opportunities for reducing the impact of the exams system on the environment”, in support of its statutory objective to promote public confidence in qualifications.

In response to this objective this report quantifies the carbon footprint of an English language GCSE. The research comprises carbon calculations, together with examples of carbon emissions reduction practice from the 4 exam boards that provide GCSEs: Pearson, AQA, OCR, and Eduqas.

Executive summary

The research calculated the carbon emissions of a single student sitting the 2 exams comprising the English language GCSE and found that the emissions were 5.6kg CO_2e or carbon dioxide equivalent. The greatest contributor to the carbon footprint of an English language GCSE is the energy used to travel to and from the school or college and to light the exam hall. Printing, packaging, and transportation of exam papers also contribute to the overall carbon impact. The research found good practice among exam boards, and an appetite to collaborate to further reduce the carbon impact of qualifications.

Methodology

Calculating the carbon footprint

A carbon footprint was calculated in line with the Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard (GHG Protocol) and closely aligned with ISO 14067 and PAS 2050 which are widely used standards for greenhouse gas accounting. The following steps were followed:

Defining the scope

An English language GCSE, as sat by a single student in 2022, was the focus of the calculation. This GCSE is assessed by 2 examinations and this research excluded the spoken element, as this is delivered in the classroom.

The study analysed the carbon footprint of the full lifecycle of the 2 exams, from the qualification development through to the disposal of exam papers. This approach is known as ‘cradle-to-grave’ in carbon accounting. Figure 1 demonstrates the lifecycle of an examination.

Collecting data

Exam boards provided relevant data on the activities that generate greenhouse gas emissions. Where specific data was not available, assumptions were used in the calculations. More details of the data and assumptions used are included in Appendix 1.

Calculating emissions

Because greenhouse gas emissions are not actively monitored in the exam system, ‘emissions factors’ were used to calculate the emissions associated with each activity. More detail on how emissions factors are calculated is included in Appendix 1.

The footprint is presented as carbon dioxide equivalent (CO_2e) - see glossary - to incorporate all greenhouse gases emitted. One candidate’s qualification, rather than the full cohort, is used as the reference quantity. This enables comparisons across jurisdictions and years without being affected by changes in the number of candidates.

The calculations on which the carbon footprint results are based were provided by Climate Partner (CP). In line with good practice, CP uses an independent third party to verify these calculations to ensure accuracy and credibility.

Identifying good practice

In parallel to the carbon footprint calculation, PA researchers spoke to exam board staff to identify the work they are doing inside their organisations and with their supply chain to reduce carbon emissions and environmental impact. This involved a series of interviews and workshops.

This report includes examples of actions being taken by exam boards and further opportunities exam boards have identified. In addition, case studies drawn from good practice are shared in Appendix 2. Case studies were selected based on demonstration of impact, transferability, and innovation.

Figure 1: The life cycle of an examination, with the core processes from the printing and packaging of exam papers to the shredding and recycling of used exam papers and scripts. The stages in between are batch delivery (transport of papers to schools), the exam event, the collection of used papers and scripts from schools, scanning and indexing them, marking and moderation awarding results and post-results services such as reviews of marking.

Results

Carbon footprint of an English language GCSE (2022)

The carbon footprint of a single student sitting a GCSE English language in 2022 was 5.64 kg CO_2e. This is approximately equivalent to 1.82km driven by an average 3-door petrol car or 5.25 wash cycles at 60 degrees Celsius.

Emission sources	One candidate's qualification (kg CO_2e)	Percentage of total
Qualification development	0.0037	0.07%
Training staff	0.0502	0.89%
Printing exam papers and scripts	0.5742	10.18%
Pre-exam transport of papers and scripts to, and storage in, schools and colleges	0.0103	0.18%
Energy use during the exam event	1.7102	30.32%
Student and staff travel to the exam	2.8618	50.74%
Post-exam transport of papers and scripts to scanning centres	0.0131	0.23%
Scanning and indexing scripts	0.2269	4.02%
Marking and awarding	0.0175	0.31%
Storage	0.1644	2.91%
Disposal	0.0078	0.14%
TOTAL	5.6400	100.00%

Figure 2.1: A breakdown of the results of the carbon footprint of an English language GCSE

The exam itself makes up the largest share of the overall carbon footprint, contributing 81% of the emissions. Of these, two-thirds are from the travel to and from the location by the candidate, invigilators and any additional staff required for access arrangements, such as a scribe for students unable to write or type.

Figure 2.2. A pie chart visualisation of the proportions of carbon impact of one candidate's English language GCSE qualification. For meaningful data visualisation, some categories have been grouped together.

If the footprint is considered without the exam event, the raw materials and energy used to produce the papers and create, scan, and index the scripts make up around 75% of the footprint. All the logistics, staff training, and marking and awarding, make up around 9% and the remaining is storage and disposal of materials. Figures 3.1 and 3.2 show these results.

Emission sources	**One candidate's English language GCSE qualification (kg CO_2e)**	**Percentage of total**
Qualification development	0.0037	0.35%
Training staff	0.0502	4.70%
Printing exam papers and scripts	0.5742	53.76%
Pre-exam transport of papers and scripts to schools and colleges, plus storage	0.0103	0.96%
Post-exam transport of papers and scripts to scanning centres	0.0131	1.23%
Scanning and indexing scripts	0.2269	21.24%
Marking and awarding	0.0175	1.64%
Storage	0.1644	15.40%
Disposal	0.0078	0.73%
TOTAL	1.0681	100.00%

Figure 3.1: A single candidate's GCSE English language qualification, excluding the energy use during the exam event and travel to the exam

Figure 3.2. A pie chart visualisation of the proportions of carbon impact of one candidate's English language GCSE qualification, excluding the energy use during the exam event and travel to the exam. For meaningful data visualisation, some categories have been grouped together.

Identifying good practice

This stage of research looked at the activity of exam boards to understand and reduce their carbon footprint. This information is provided as a qualitative commentary against the carbon footprint calculation, to highlight examples of good practice that may have broader application. Ofqual does not regulate the environmental performance of exam boards, and so this is not an assessment of specific regulatory compliance.

Understanding organisational carbon footprints

This research found that most exam boards publish their emissions reports online, as part of their Annual Reports. This helps them to understand the impact of their supply chain through working with consultants and suppliers to gather data. Most of the boards are also implementing environmental management systems (EMS), achieving accreditation for BS 8555 and ISO 14001 standards.

Reducing carbon footprints

Exam board in-house operations (qualification development and training staff) contribute 1% to the carbon footprint of a GCSE. All exam boards have made commitments to reduce the impact of their internal operations. Good practice includes setting long-term energy strategies, improving the energy efficiency of buildings, switching to renewable energy, and reducing employee travel. Appendix 2 Case Study 1 looks at measuring environmental impacts at OCR.

Exam board supply chains – for printing, packaging, logistics and end of life process – contribute 18% to the carbon footprint of an English language GCSE. Securely delivering good quality papers to a dispersed network of schools imposes constraints on carbon reduction opportunities, but there are several good practices being adopted.

Exam boards are changing procurement processes to embed emissions reductions into their supply chain. Good practice includes supplier approval systems, where suppliers are scored on environmental management practices, and the evaluation of existing suppliers. In some cases, emissions reduction targets are included in contracts.

The paper and packaging used to produce and ship exam papers and scripts creates environmental impact in both its production and disposal. Good practice includes reducing the

volume of paper used, by minimising blank pages, improving quality control to avoid re-prints, and putting supporting documentation online. Exam boards increasingly use paper from sustainable sources and recycled materials for packaging. Appendix 2 Case Study 2 looks at increasing recycled material in packaging at Eduqas.

Transporting exam papers and scripts by road using HGVs creates emissions. Security requirements and the geographic dispersal of schools affect the options available, but good practice includes minimising the number of deliveries made to schools and colleges through improved batching and more accurate forecasting of needs.

After the exam, papers are scanned and then disposed of. Good practice includes working with schools and colleges for the recycling or return of materials, ensuring that disposal of papers through recycling is optimised, and working with green IT providers to reduce the digital scanning and storage carbon impacts. Appendix 2 Case Studies 3 and 4 look at end-of-life processes at Pearson and AQA.

Discussion

Most carbon emissions of an English language GCSE come from travel to the exam location and then from the heating and lighting of that location. While this is a valuable insight, it is perhaps best seen as a sub-set of the total schools' and colleges' attendance footprint. Carbon emitted to attend an exam at a centre is not substantively different from that emitted to attend a class at the same centre. The same could be said of the second-largest carbon contributor: the heating and lighting of 'exam room' spaces within schools, which will be used for other purposes when exams are not taking place.

There is opportunity to reduce carbon emitted from other factors, beyond that emitted in the schools and colleges where exams take place. This impact is associated with the need to print, package, distribute, collect, and dispose of large amounts of paper, and to scan and index completed scripts digitally. Here the research shows good practice from exam boards across the full supply chain.

While there are examples of good practice, there are further opportunities to standardise that across the industry. Exam boards do not see carbon emissions as a point of competitive differentiation and have an appetite to share approaches and collaborate. This includes the potential to work together on common targets, to share data, and to develop common solutions, such as using recycled packaging.

There is potential in the future for more exams to be delivered digitally. This is dependent on separate evidence-based assessment of the benefits and risks. Increased digital delivery would change the character of carbon emissions – replacing paper-based emissions with electrical equipment manufacture and energy consumption – but it is difficult to estimate whether or not it would reduce, or even increase, emissions. Location of exams, whether paper or digital, would remain the main factor in determining emissions.

There are limitations to this research. The research calculates the footprint of a single student taking an English language GCSE but cannot be used to provide an overall carbon emission estimate for an entire exam series. Multiple exams are held on a single day and, while there are

broad similarities between qualifications, a GCSE in English language cannot be definitive for all other GCSEs or for different types of qualifications.

Looking at an individual as representative of a cohort is likely to mask a high degree of variation that may be instructive. It is likely that the geographical variation of carbon emissions is high, and an understanding of that may help suggest specific strategies for reduction. Further granularity, and a deeper understanding of the specific categories, would be required to make the conclusions operational, and may hold further strategic insights.

Conclusion

The purpose of this report was to measure the carbon footprint of a high entry GCSE, as a first step towards being able to ensure a sustainable assessment system. This was investigated by quantifying the carbon emissions of English language GCSE, which is compulsory, and identifying good practice in the understanding and reduction of those emissions. This information has the potential to help both target carbon reduction efforts and to standardise good practice across those involved in the exams system.

While the report found that most emissions are outside the control of those involved in the exams system, things can be done to reduce emissions of the elements under greater control. Once travel to – and lighting of – exam venues is excluded, printing, packaging and distributing exam papers and scanning scripts are the main sources of carbon emission. Action can be taken on each aspect.

Exam boards are reporting their emissions and are acting to reduce those emissions within their own operations and those of their suppliers. The purpose of this research was not to evaluate progress or to identify standards to strive toward, but to highlight examples of good practice. Through this work, it was clear there is an appetite among exam boards to work together on reducing carbon emissions.

Appendix 1 - Carbon footprint data: Assumptions and limitations

Carbon footprint output

The tables in this section show the output of the carbon footprint calculation.

Table 1.1: Development of qualification

Emission	One candidate's English language GCSE qualification (kg	Percent

sources	CO2e)	(%)
Energy use	0.0037	100%
Total	0.0037	100%

Table 1.2: Training

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Energy use	0.0502	100%
Total	0.0502	100%

Table 1.3: Printing

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Production: raw materials and energy use to generate exam papers	0.5547	96.6%
Inbound logistics: transport of raw materials to printing site	0.0048	0.48%
Product packaging: packaging around the exam papers	0.0147	2.56%
Total	0.5742	100%

Table 1.4: Pre-exam logistics

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Transport of paper (pre-exam)	0.0031	29.93%
Storage of exam papers (pre-exam)	0.0072	70.07%
Total	0.0103	100%

Table 1.5: The examination(s)

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Energy use	1.7102	37.41%
Transport of attendees	2.8618	62.59%
Total	4.5720	100%

Table 1.6: Post-exam transport

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Logistics from exam centres to scanning centres	0.0131	100%
Total	0.0131	100%

Table 1.7: Scanning and indexing

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Energy use	0.0609	26.83%
Fuel usage (forklift trucks)	0.1660	73.17%
Total	0.2269	100%

Table 1.8: Marking and awarding

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Energy use	0.0175	100%
Total	0.0175	100%

Table 1.9: Storage

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Digital storage	0.0005	0.30%
Physical storage – transport to storage	0.0782	47.57%
Physical storage – energy use	0.0857	52.12%
Total	0.1644	100%

Table 1.10: End-of-life qualification

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Waste throughout the life cycle of the qualification	0.0078	100%
Total	0.0078	100%

Table 1.11: Total carbon footprint calculation by section

Emission sources	One candidate's English language GCSE qualification (kg CO2e)	Percent (%)
Table 1.1: Development of qualification	0.0037	0.07%
Table 1.2: Training	0.502	0.89%
Table 1.3: Printing	0.5742	10.18%
Table 1.4: Pre-exam logistics	0.0103	0.18%
Table 1.5: The examination(s)	4.5720	81.06%
Table 1.6: Post-exam transport	0.0131	0.23%
Table 1.7: Scanning and indexing	0.2269	4.02%

Table 1.8: Marking and awarding – energy use	0.0175	0.31%
Table 1.9: Storage	0.1644	2.91%
Table 1.10: End-of-life qualification	0.0078	0.14%
Total	5.6400	100%

Data collection and emissions factors

The data collected for the carbon footprint measurement is classified as primary and secondary. Primary data is collected at the source and applies to a specific activity researched. Secondary data is obtained by processing and modelling the primary data for example, using lifecycle analysis databases such as Ecoinvent. Where primary data was unavailable for the footprint calculation in this report, the gaps were closed using assumptions listed in the following section.

When compiling a carbon footprint, a combination of activity data and emission data was used. Activity data describes the event, for example for a truck driving from London to Birmingham; its activity data would be the weight and make of the truck and the kilometres travelled, or the litres of diesel burned.

Emission data describes the greenhouse gases emitted during the activity, or for the activity to take place. For example, a truck on its journey from London to Birmingham burns diesel in its engine releasing several different greenhouse gases in different quantities. These emissions, once calculated, are expressed as a weight of CO_2e, or carbon dioxide equivalent.

Activity data and emission data are then combined to form what is termed an emission factor. For example, having measured the emissions of our truck and knowing how far it travelled, we now know the average emissions released per tonne of goods carried per kilometre by this truck. This would give us an emission factor per tkm (tonne kilometre) for a particular truck, let us say 0.2 kg CO_2e per tkm (per kilometre travel carrying a tonne of weight). This means that if the truck were to then take a journey from Birmingham to Edinburgh (471km) carrying 15 tonnes of goods, (7,065tkm), we could apply the emission factor of 0.2 kg CO_2e per tkm to know that the emission from that journey would be 1,413 kg CO_2e. Because trucks do not monitor the greenhouse gas being emitted when not under test conditions, emissions factors are used across the carbon accounting industry to calculate greenhouse gas emissions from readily accessible activity data.

Emissions factor sources

This table is a summary of the sources used for emissions factors that were used in the calculation of the carbon footprint of a GCSE English language qualification.

Life cycle stage	Element	Source
Development of Qualification & Training	Electricity UK – in person training and online training	Ecoinvent 3.8 database
Development of Qualification & Training	Gas UK – in person training	DEFRA 2021 emission factors
Development of Qualification & Training	Mobility – in person training	Ecoinvent 3.8 database and DEFRA 2021 emission factors
Printing	Paper	Ecoinvent 3.3 database
Printing	Product packaging: LDPE granulate, LDPE film, Ink, Extruding (plastic), Corrugated cardboard box	Ecoinvent 3.8 database
Printing	LDPE granulate, recycled	ClimatePartner emission factor derived from research paper
Printing	Inbound logistics	Ecoinvent 3.8 database and Smart Freight Centre data
Pre-Exam Logistics	Logistics	EcotransIT
Pre-Exam Logistics	Storage - Electricity	Ecoinvent 3.8 database
Pre-Exam Logistics	Storage - Natural Gas	DEFRA 2021 emission factors
The Examination	Examination Room - Electricity	Ecoinvent 3.8 database
The Examination	Personal transport - Bicycle/car	Ecoinvent 3.8 database
The Examination	Personal transport - Bus and Rail	DEFRA 2021 emission factors
Post-Exam Transport	Logistics	EcotransIT

Scanning and Indexing	Electricity UK	Ecoinvent 3.8 database
Scanning and Indexing	Other fuel	DEFRA 2021 emission factors
Scanning and Indexing	Logistics	Ecoinvent 3.8 database
Marking	Electricity UK	Ecoinvent 3.8 database
Marking	Homeworking	ClimatePartner derived emission factor from EcoAct (2019): Homeworking emission Whitepaper
Storage	Digital Storage	ClimatePartner derived emission factor using data from Statistica and International Energy Agency
Storage	Physical Storage - Electricity	Ecoinvent 3.8 database
Storage	Physical Storage - Gas	Defra 2021 emission factors
End of Life	Treatment and transport to treatment centre	Ecoinvent 3.8 database and Eurostat Data

Activity and emissions data is grouped as primary, secondary, or tertiary according to data quality.

Primary data is real world data, for example: the quantity of fuel consumed by a truck carrying a specific weight on a specific journey.

Secondary data is real world data applied to a comparable event for example: the average quantity of fuel used by a truck per km applied to a journey done by another truck which is the same size, but carrying different weight on a different length journey.

Tertiary data is real world data applied to comparable collective data for example: the average quantity of fuel used by an average truck per tkm applied to a fleet of trucks of varying but similar sizes with varying loads. We know the total load hauled, and the total distance covered by the whole fleet and the emission factor is applied to the collective data.

Another example of tertiary data would be utilising national statistics for waste disposal. Where there is no data available for how a specific item has been disposed of (meaning recycled, landfill, incineration, and so on) waste treatment methods based on national statistics would be applied.

Data and assumptions

In a perfect world, all the data needed to create a complete carbon footprint would be available,

but it is often the case that the process to calculate a carbon footprint requires data that might not otherwise be gathered or readily available. For example, for the examination of this footprint, ideally the energy usage data for every exam centre and room used for the day of the exams and the number of candidates per room would be used. In the absence of that data, assumptions have been made on the types of energy used, for example, because exams were sat in summer, it was assumed that lighting was used but heating was not.

All emission factors used were derived from international databases, including Ecoinvent and Defra. All greenhouse gases were taken into account for the calculation and are represented in carbon dioxide equivalents (CO_2e) to enable comparability and reduce complexity.

A summary of the assumptions used in the calculation of the carbon footprint of an English language GCSE are set out in the following section.

Qualification development

Qualification development includes both development of the qualification and the exam material development: reviewing the performance of question papers from previous years, drafting, commenting, reviewing, re-drafting, approving question papers and the marking scheme. It also includes typesetting, creating graphics and approving copyright for all iterations of the question paper, including those modified to provide access arrangement. In 2022 most of this process was carried out remotely within the UK. This combined with lack of available data means that we have not included any employee commuting here as it was deemed immaterial.

We have assumed that all work is carried out on a laptop using average power consumption of 0.2 kWh per hr.

Where work was expressed in weeks or months we have assumed a working day or shift is 8 hours, and that that there are 4.34 weeks in a month.

Training

Training includes the educator training provided by the exam board for those working with candidates on the exam syllabus and to markers of exam papers. Primary activity data was provided by some exam boards. Where data was unavailable, the gap was filled by extrapolation based on available primary data from other exam boards.

Printing of exam papers (papers 1 and 2)

This includes raw materials for the papers (paper, ink, staples and stitching), the packaging in which the exams are shipped out and the packaging in which they will be returned. Where packaging can hold for example 5, or 10, or 20 papers, the smallest configuration was used as it

would provide the most conservative estimate of emissions.

This includes transport of raw materials and packaging to the printing centres. No data was available for the distance travelled by product packaging between tier 1 suppliers and the print centres. A standard assumption of transporting the total packaging weight 450 km by a 16 to 32 tonne lorry was applied, based on the assumption the packaging originated in the UK.

Energy usage for the printing of the papers was included. Due to lack of primary energy consumption data this has been derived using an industry-specific printing average.

Pre-examination logistics

Primary weight data was available for 99% of candidate papers distributed, and primary activity data was available for 78% of candidate papers' journeys from printing or storage to exam centres. The exact distance data was unavailable for the remaining 22% and was therefore extrapolated based on the available primary data.

Given the distances covered by the papers, it was assumed that the logistics were carried out by a 16 to 32 tonne lorry and a standard emission factor was applied accordingly.

The examination

Examination length

The 2 papers for the 4 exam boards ranged in length from 1 hour and 45 minutes, to 2 hours and 5 minutes. A weighted average was applied to determine energy usage in the examination room. The same principle was applied to account for candidates whose access arrangements involve extra time.

Adjustments for accessibility

Data is collected and published by Ofqual regarding the number of candidates with approval for access arrangements to facilitate their participation in GCSE exams for the academic year 2021 to 2022. Data on how many candidates then use those arrangements for any given paper was unavailable, therefore we have assumed that where access arrangements have been granted, they have been used. The following weightings were applied:

- Candidates with 25% extra time: 26.22 %
- Candidates using a laptop: 8.91 %
- Candidates with 50% extra time: 0.48 %
- Candidates with a plus one*: 3.67 %
- Candidates with no access arrangements: 60.72 %

*This includes all candidates with a practical assistant, or a scribe.

Size of examination room and energy usage

The Joint Council for Qualifications provides examination centres with Instructions for conducting examinations. This document details that the “minimum distance in all directions from the centre of one student’s chair to the centre of another’s must be 1.25 metres” giving each candidate a minimum area of 1.5625 m2. Data for energy and fuel consumption at the exam centres was unavailable due to time constraints, therefore standard assumptions for UK electricity consumption per m2 were applied. We did not include any heating element in this calculation as the exams occurred in May and June. Where access arrangements permit the use of a laptop we have assumed that all work is carried out on a laptop using average power consumption of 0.2 kW per hour.

Travel to the examination(s)

Candidates’ travel

For all boards, 2 examinations took place on separate days. We have assumed, however, that on any given day of examination the candidates will be sitting more than one paper and their travel to and from the exam centre has been split accordingly. Data showing how 5 to 16 year olds living in England get to or from school has been collected annually between 2002 and 2019 and is published by the Department for Transport. The data shows 5-year averages from April 2002 to March 2019, and we have used the most recent data set (2015 to 2019) to determine an average emission factor per candidate trip to and from school on the basis that for the majority of candidates their school will host their examinations. Whilst it may be the case that some candidates travel to their examinations using a different mode of transport to their usual journey, we believe this to be a reasonable proxy given the lack of alternative data.

Invigilators’ travel

The Joint Council for Qualifications (JCQ) stipulates that there must be one invigilator present for every 30 candidates. To be conservative we have assumed that they are invigilating one sitting per round trip. UK average commute data from the 2021 census was used to determine an emission factor for all invigilators.

Scribes, readers and practical assistants’ travel

3.67% of students were granted permission to have a plus one. We have assumed that where applicable there is one scribe or reader or practical assistant assigned per candidate, and that they are attending 2 sittings per round trip. UK average commute data from the 2021 census was used to determine an emission factor for all scribes, readers and practical assistants.

Post-examination logistics

Primary distance and weight data was available for 99% of candidate papers for their journeys from the exam centres to the scanning locations. The remaining 1% was extrapolated based on

the available primary data.

Given the distances covered by the papers, it was assumed that the logistics were carried out by a 16 to 32 tonne lorry and a standard emission factor was applied accordingly.

Scanning and Indexing

Primary activity data was supplied for 99% of candidate papers scanning and indexing process. The remaining 1% was extrapolated based on the available primary data.

Due to the lack of consumption data, the following power consumption assumptions were made for electronic equipment used in the scanning and indexing process:

- logging onto an average PC, with a monitor – 0.382 kWh
- scanning using an RS Gammerler Rotary trimmer followed by scanning using a PS1000 – 7.8 kWh
- indexing using average power consumptions for freestanding laser printer, label printer, and barcode scanner – 1.227 kWh

A combination of primary and secondary activity data was provided for the use of onsite forklift trucks to process the papers and move them onto transportation ready for storage.

Marking and awarding

This includes ‘prime’ marking, reviewing, training of markers for 99% of papers, it also includes post-results reviews of marking for 12% of papers. It was assumed that all markers were home workers and so no commuting data has been included here.

As the exams are marked in the summer, no heating has been applied to the energy usage.

We have assumed that all work is carried out on a laptop using average power consumption of 0.2 kW per hour.

Where the data for this work was provided in weeks and months, we have assumed a working day is 8 hours, and that that there are 4.34 weeks in a month.

Storage

Digital storage

Primary activity data was supplied for 90% of digital storage. The remaining 10% was extrapolated based on the available primary data.

Physical Storage

Primary activity data was supplied for 90% of physical storage. The remaining 10% was extrapolated based on the available primary data.

Disposal

Where information is available, the footprint has also included the disposal of packaging material including:

- transportation boxes used to get the papers to the centres and return the scripts to the scanning centres
- secure question paper packaging, which consists of the opaque bags to contain exam papers for distribution to exam centres
- script sacks, which are bags supplied to centres to ensure scripts are not tampered with on their return journey
- storage boxes and pallets

Due to the lack of data available regarding the waste disposal methods used by exam centres, waste treatment methods based on national statistics and average transport distances of 25km to a waste disposal facility were assumed for any packaging item disposed of by exam centres.

A combination of primary and secondary activity data was provided by the exam boards regarding the disposal of waste throughout the value chain. Whilst most boards had sight of exam paper/script disposal, wastage at the printing centres and elsewhere in the value chain was less visible. Waste treatment methods based on national statistics and average transport distances of 25km were used where data was unavailable.

Appendix 2: Case studies

Case study 1: Measuring environmental impact – OCR (owned by Cambridge University Press & Assessment)

What environmental impacts are being addressed?

The University of Cambridge has set a goal to achieve carbon zero on energy-related emissions by 2048. OCR is part of the Cambridge University Press & Assessment group of exam boards which, as a devolved department of the University, are aligned with the 2048 target. Calculating and mapping greenhouse gas emissions allows OCR to understand the impact of each stage of their value chain on the environment and identify ways to minimise that.

What were the considerations and action taken?

OCR, along with the rest of Cambridge University Press & Assessment, adopted the Greenhouse Gas Corporate Protocol. They also opted to set emissions reduction targets in line with the Science Based Target Initiative methodology and to incorporate the Carbon Disclosure Project and Global Reporting Initiative data standard and methodology into their data gathering approach. They do not include any carbon off-setting.

Emissions data is captured and tracked in a digital tool that is used globally across Cambridge University Press & Assessment for a wide range of environmental data. The organisation is also working with the UK Publishers Association to develop a tool for calculating the end-to-end footprint of a book, and using a web application tool, DIMPACT, to map the emissions of online digital media.

How was the approach implemented and were there any barriers to overcome?

OCR worked with an external consultant to identify which categories in the Greenhouse Gas Corporate Protocol make the biggest contribution to their emissions, which include the purchase of goods and services and the transportation and distribution of goods. Capturing energy-related emissions (Scope 1 and 2 of GHG Protocol) is supported by a team of volunteer data gatherers around the world. The volume of data needed to calculate Scope 3 emissions – those in their supply chain – meant they needed a bigger team, including data analysts and project managers, who work across Cambridge University Press & Assessment.

What has the impact been so far and what is anticipated?

Measuring their greenhouse gas emissions provides a picture of the systems, tools, and behaviours that will need to change in the future to meet annual emissions reduction targets. This led to OCR including clauses in contracts with suppliers to ensure they provide the data necessary for OCR to produce accurate Scope 3 calculations. The exam board identified freight as one of the biggest emissions hotspots and is exploring options to reduce these. Opportunities to reduce the volume of paper used in exams, for example by removing blank pages, have also been identified. The data are informing business decisions, so OCR is working to embed this into its internal processes as well as ensure the necessary checks on investment in new projects and resources are factored into timelines for project delivery.

Case study 2: Increasing recycled content of packaging – Eduqas

What environmental impacts are being addressed?

Eduqas wanted to reduce the environmental impact of the packaging used to transport exam papers, including the raw materials and energy used in manufacturing of plastic, paper and cardboard.

What were the considerations and action taken?

Eduqas explored alternative materials to plastic for use in their packaging. They considered the trade-offs on quality, security and overall environmental impact. They asked their suppliers to suggest alternatives and assessed the feasibility of switching from plastic to compostable plant-based packaging, but compostable material was judged unsuitable to provide confidence a paper

has not been viewed or opened before the exam. Eduqas also noted that the facilities needed to compost the packaging were not available to all local authorities, and were concerned about the emissions associated with sourcing packaging from outside the UK.

They did, however, find that they could increase the recycled content of their plastic packaging made from low density polythene (LDPE). They found a supplier who could provide packaging with up to 86% recycled LDPE and are now using this for both their external mailers and script return sacks (the security bags used to send exams to schools and colleges, and those used to return completed scripts to exam boards).

Eduqas also reviewed its cardboard use and replaced some plastic packaging with cardboard alternatives. The advantage of cardboard is that it can be recycled by schools, colleges and local authorities, whereas many aren't able to recycle LDPE. Eduqas changed the design of cardboard boxes to reduce size and volume of material used. The exam board also switched from tape containing plastic to one which is fully recyclable alongside the boxes.

How was the solution implemented and were there any barriers to overcome?

Working with suppliers and identifying new ones was important in making these changes. The introduction of the plastic packaging tax helped to open the conversation about using recycled feedstock (materials produced by the recycling of waste) further and Eduqas has secured a second supplier who can also provide packaging with 86% recycled LDPE. Eduqas notes that price is no longer a particular barrier as suppliers with high recycled content can offer competitive prices.

What has the impact been so far and what is anticipated?

Changing the size and shape of packaging has had a benefit in reducing overall tonnage of packaging used and therefore reducing environmental impacts. As part of the continued focus on waste reduction with particular regard to packaging materials, this supported the aim of avoiding the requirement to register as a 'waste producer'. Reducing the amount of virgin materials being extracted and produced has helped to limit the emissions for which Eduqas is responsible through its supply chain.

Case study 3: Collaborating with schools and colleges – Pearson

What environmental impacts are being addressed?

Pearson wanted to reduce the volume of packaging used in the distribution of question papers and scripts, reduce wastage and identify options for recycling at schools and colleges.

What were the considerations and action taken?

Pearson engaged with and visited schools to understand how they could collaborate to reduce the waste from the transport of exam papers and scripts. In particular this enabled them to identify the opportunities and challenges in schools of recycling packaging, including the limits on recycling facilities available through local councils and ability to compost biodegradable materials such as cardboard and plant-based packaging. Pearson considered the use of compostable films, but at

the time both risks around security standards, and in-centre functionality to compost, meant that other options were pursued.

They also discussed the feasibility of increasing accuracy of candidate data, to reduce the likelihood of needing to send extra materials, which increases a carbon footprint by using boxes and couriers for small batches of exam papers.

How was the solution implemented and were there any barriers to overcome?

Pearson's engagement with schools was focussed on helping them reduce barriers to implementing future solutions. Discussions with school staff, particularly exams officers, helped Pearson to build an understanding of the pressures of roles with exam responsibilities, such as administrative burden, which can lead to high turnover. They concluded that any future initiatives should simplify processes as a priority.

What has the impact been so far and what is anticipated?

Engagement with schools has led to the opening of constructive discussion about ways to collaboratively reduce environmental impact. For example, schools were keen to explore a process for returning packaging, similar to the way they return exam scripts. This would allow the exam board to take responsibility for recycling of packaging en masse and reduce reliance on individual council recycling facilities.

Case study 4: Reducing distance travelled for recycling – AQA

What environmental impacts are being addressed?

AQA wanted to reduce the environmental impact of exam paper disposal. The exam board stores over 100,000 boxes, equivalent to 225 tonnes of material which must be moved to a recycling facility and securely destroyed, including 37 tonnes of cardboard and 15.5 tonnes of plastic packaging.

What options were assessed as potential solutions, which option was chosen and why?

AQA is switching its waste disposal contract to a company closer to its offices, which will reduce road transport and associated emissions. The top priorities in making this decision were to:

- secure the necessary quality of service
- meet service level agreements regarding collection frequencies and secure disposal of exam scripts

AQA knew, however, that there would be environmental benefits by reducing road freight emissions, which was an important part of the new supplier selection.

They had previously used vehicles to take their waste on a 230-mile round trip which incurred extra costs. AQA intends to ring fence the money saved from changing supplier to use for carbon reduction projects.

How was the solution implemented and were there any barriers to overcome?

Once a closer waste disposal supplier was found, it was straight forward to onboard the supplier and agree reporting requirements to track recycling volumes. Finalising the secure disposal requirements and certification has taken more time, but the new supplier should be in place ahead of disposal of the summer 2023 scripts. The initial investment in the new system is forecast to break even in 2 years.

What has the impact been so far and what is anticipated?

AQA is in the process of switching supplier, so is yet to see the benefit during peak operations for summer series delivery. Based on summer 2022 collection frequencies, the exam board has calculated a reduction of at least 15.88 tonnes CO2e per year. The reduction is based on a slightly reduced collection frequency, but this is expected to further decrease as they will compact more waste on site to minimise the number of waste collections needed. Due to the waste compaction, the weight of waste in one container can be maximised, which not only reduces the emissions from road transport but also attracts a bulk waste rebate. Based on 2022 collection weights, AQA estimates it will receive £5,000 to £7,000 in annual rebates from the waste management company. The board plans to reinvest this money in sustainable initiatives, such as installing extra electric vehicle charging for staff and offsetting the cost increase of using train travel as their preferred transport.

Appendix 3 - Glossary

Carbon dioxide equivalents (CO2e) show that in addition to carbon dioxide, the calculations also address the other six greenhouse gases regulated by the Kyoto Protocol: methane (CH4), nitrous oxide (N2O), sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and nitrogen trifluoride (NF3). These gases are converted to the global warming potential value of CO2 and represent CO2 equivalents (CO2e). These equivalents are usually referred to as carbon emissions or CO2.

Emissions factors are coefficients that represent the amount of greenhouses gas emissions released per unit of activity data. They are used to convert activity data, such as energy consumption or transportation miles, into greenhouse gas emissions.

Exam boards are organisations that set examinations and awards GCSE and AS and A level qualifications.

Greenhouse gas is any gas in the atmosphere which absorbs and re-emits heat, thereby keeping the planet’s atmosphere warmer than it otherwise would be. The most common greenhouse gases in the Earth’s atmosphere are water vapour, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and ozone. Greenhouse gases occur naturally in the Earth’s atmosphere, but human activity, such as burning fossil fuels, increases the amount of greenhouse gases in the atmosphere to above normal levels.

Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard (GHG Protocol) isan internationally accepted methodology which enables the greenhouse gas management of a company’s goods and services. It was developed by the World Resources Institute (WRI) and the

World Business Council for Sustainable Development (WBCSD).

It defines 5 fundamental principles for carbon footprint measurement:

- Relevance. The principle of relevance requires that all major emission sources are taken in consideration when measuring corporate carbon footprints. The report should be informative and useful in internal and external decision making.
- Completeness. The principle of completeness requires that all relevant emission sources within the boundaries are addressed and included.
- Consistency. To facilitate the comparison of the results over time, accounting methods and boundaries must be documented and kept for the record. Any changes in the methodology and/or boundaries must be reported, explained and justified.
- Accuracy. Discrepancies and uncertainties that may occur during the calculation and measurement process should be reduced as much as possible to make sure that the results are accurate and provide solid data for stakeholder decisions.
- Transparency. The results should be presented in a transparent and comprehensible manner.

Location and market-based scope 2 emissions. There are 2 approaches to calculating greenhouse gas emissions – the location-based and market-based methods. These are most commonly applied when looking at Scope 2 electricity emissions, and both must be used when relevant when following the GHG Protocol in a process known as ‘dual reporting’.

- Location-based method looks at the emissions from an entity’s electricity usage based on the average of all the emissions from the electricity grid across a set period and area. For the purposes of this footprint that area is the United Kingdom and the period is a year. This method is focussed purely on the grid mix and does not factor in an organisations specific energy purchasing decisions.
- Market-based method looks at the emissions from an entity’s electricity usage based on their energy tariff, or other energy procurement such as the purchase of Renewable Energy Certificates or Power Purchase agreements. This enables organisations to account for their specific and hopefully ‘renewable’ energy purchasing decisions.

For the purpose of this report, Scope 2 emissions have been accounted for using location-based method only.

Net zero refers to a state in which the greenhouse gases emitted into the atmosphere are balanced by the equivalent amount of greenhouse gas removed.

Science based targets are a set of goals developed by a business to provide it with a clear route to reduce greenhouse gas emissions. An emissions reduction target is defined as science based if it is developed in line with the scale of reductions needed to keep global warming below 2°C from pre-industrial levels. More ambitious business’ also have the option of setting targets that keep global warming levels to below 1.5°C.

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