



University of
St Andrews

Institute for Museums,
Heritage and Society

Guide to Carbon Calculators for Digitisation Projects in Museums

The Environmental Cost of Digital
Technologies in Museums Project

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Overview

Document purpose

This document provides an overview of a range of carbon calculators that cultural organisations may use to understand the carbon cost of their digitisation projects, either as a whole or by stage. It can be used by all who are involved in digitisation activities, from those beginning their digitisation journey to those seeking to reflect on established projects.

In the context of this document, a digitisation project begins when the digitisation of an object or collection is first considered and ends at long-term preservation of the digitised object or collection. We acknowledge that environmental costs extend far beyond carbon, however here we focus only on this element of a wider and more complex picture.

Methodology

The carbon calculators included in this document were chosen based on desktop research and recommendations from experts. Initial scoping began in 2024 and the list was refined in 2025 and 2026. We began by taking a wide view, considering carbon calculators beyond the GLAM (Galleries, Libraries, Archives and Museums) sector and those that deal with digital-only operations. The resulting list is not intended to be comprehensive but includes calculators that are deemed to be most relevant to a range of cultural institutions.

Once the initial list was identified, the carbon calculators were evaluated based on ease of use, relevance to the GLAM sector, and ability to measure digital outputs. We endeavoured to prioritise calculators that are free to use. However, given the limited availability of such calculators, we have also included some that require sign-up and/or are behind paywalls. Any paid components are clearly marked in the document.

Results

We were unable to find a single tool that calculated the carbon cost of the digitisation process from capture to data storage and preservation. In the absence of this, we have gathered several tools in this document that calculate portions of the digital and physical carbon costs of a digitisation project. We believe that physical and digital carbon costs can be assessed together as part of a holistic view of cost, so we have also included physical-only calculators that directly incorporate GLAM-related inputs.

The Environmental Cost of Digital Technologies in Museums project advocates for more comprehensive digital carbon calculators in the arts.

How to use this document

We understand that organisations have different needs. We have organised this document so that you can tailor your approach to carbon measurement. It is divided into sections based on the scope of the calculators: digital-only, physical-only and a mix of both. The final section includes calculators that are tailored to specific aspects of the GLAM sector, including events and digital arts.

Our recommendation is to review the list based on the needs of your project and to choose the calculators that are most relevant. Often, you may be required to combine or use multiple calculators that cover different stages of the digitisation process. We also recommend benchmarking your data for future comparison and sharing it with other GLAM organisations.

This document can be used in combination with the other tools developed by *The Environmental Cost of Digital Technologies in Museums Project*. We have indicated where each calculator sits in the digitisation process, aligning with our diagram in the *Mapping the Environmental Cost of the Digitisation Process* document. Outputs from these calculations can also be critical components of justifying the environmental costs of digitisation projects for your organisation, and we provide a framework for this in the *Assessing the Value of Digitisation Projects* workbook. Both documents can be found on *The Environmental Cost of Digital Technologies in Museums Project* [website](#).

Digital-only carbon calculators

Calculators which measure the carbon output of digital aspects of an organisation.

<p><u>InformU CO₂</u></p> <p>Cost: paid for</p> <p><i>Relevant project phases: project set-up, data storage and preservation.</i></p>	<ul style="list-style-type: none">• Offers a comprehensive suite of carbon measurement tools for cloud storage, on-site data centres, artificial intelligence and individual devices. Includes evaluation of storage efficiency.• Provides consultancy services for more tailored assessment of environmental costs within an organisation.• Requires a subscription to access tools, with some discounts available for the charity sector. Offers tiered pricing, including a CO₂ only option. <p><i>For organisations who want to invest in a multi-pronged digital measurement rather than relying on a combination of multiple calculators.</i></p>
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Data storage / Machine learning only:

<p><u>Data Carbon Ladder, University of Loughborough</u></p> <p><u>Carbon Calculator</u> only</p> <p>Cost: free</p> <p><i>Relevant project phases: project set-up, specifically the team members included, as well as connectivity and communication.</i></p>	<ul style="list-style-type: none">• Offers three data measurement tools: Data Carbon Calculator, Data Carbon Scorecard and Data Carbon Ladder.• The Data Carbon Calculator determines data generated by number of employees so may not provide the nuance that is necessary for arts-specific organisations or digitisation projects.• The Data Carbon Scorecard may be used to evaluate the value of aspects of a digitisation project.• Intended to “facilitate insightful discussions surrounding the conceptualisation of new data projects and their potential environmental ramifications.” <p><i>Good quick evaluation of data used by number of employees and to determine the environmental trade-offs of new data projects.</i></p>
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<p><u>ML CO₂ Impact</u></p> <p>Cost: free</p> <p><i>Relevant project phase: project set-up (software).</i></p>	<ul style="list-style-type: none"> • Calculates carbon footprint (kgCO₂) for machine learning aspects of an organisation based on hardware type, hours used, provider and region. • Also offers a software that integrates carbon estimations into Python workflow. <p><i>Useful as a quick-to-calculate machine learning component of the digital carbonisation process.</i></p>
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Website only:

<p><u>Digital Beacon</u></p> <p>Cost: free</p> <p><i>Relevant project phase: data storage & preservation (if content included on website).</i></p>	<ul style="list-style-type: none"> • Simple interface that creates a brief website report. • Long list of outputs including page breakdown, history and a grading system based on outputs. <p><i>Quick measurement of website with a longer list of outputs. Best for websites that have only a few sub-pages.</i></p>
<p><u>Digital Carbon Online</u></p> <p>Cost: free (for basic features)</p> <p><i>Relevant project phase: data storage & preservation (if content included on website).</i></p>	<ul style="list-style-type: none"> • Provides a range of outputs including comparison with other activities, carbon emissions by page, and benchmarks against other tested websites. • Free to run initial report but requires sign-up and payment for enterprise-sized websites (up to 500 sub-pages). <p><i>Provides a detailed website calculation and report. Best for larger organisations and websites.</i></p>
<p><u>Website Carbon Calculator</u></p> <p>Cost: free</p> <p><i>Relevant project phase: data storage & preservation (if content included on website).</i></p>	<ul style="list-style-type: none"> • Possible to submit your website and receive overall ranking, amount of CO₂ per page view as well as CO₂ and kWh for average number of monthly page views. • Option to add a badge with measurement information to your website. • Each page of a website must be entered individually. <p><i>Quick measurement of the carbon rating of your website. Best for websites that have only a few sub-pages.</i></p>

Physical + digital carbon calculators

Calculators which primarily measure physical aspects of an organisation but offer options to integrate digital.

<p><u>Gallery Climate Coalition</u></p> <p>Cost: free (for basic features)</p> <p><i>Relevant project phases: project set up (connectivity, communication), studio set-up (energy usage, materials), data storage & preservation (cloud storage, websites).</i></p>	<ul style="list-style-type: none">• Tailored specifically to the arts-sector and includes digital and physical variables.• Offers two tools: a Quick Calculator (physical-only) or a full Carbon Calculator (digital input possible).• Defines “digital” as websites, video calls, cloud storage and emails. The website calculator section directs users to the Website Carbon Calculator (included on list above) and requires some patchwork reporting.• The Quick Calculator is free to use, and an expanded Calculator is available after sign-up. <p><i>Best for an arts-specific starting point for collecting all types of carbon footprint data and for pulling detailed reports.</i></p>
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Physical-only carbon calculators

Calculators with no digital measurement, but with easy-to-use functionality and /or connection to the arts sector.

<p><u>Carbon Management, Culture for Climate Scotland</u></p> <p>Cost: free</p> <p><i>Relevant project phases: project set-up (hardware), studio set-up (materials, energy usage).</i></p>	<ul style="list-style-type: none"> • Offers multiple arts-industry focused measurement tools, all based in Excel. These include: a carbon management planning tool, quick carbon calculator, emission reduction plan summary tool and carbon budgeting tool. • The quick carbon calculator offers a wide range of inputs, including “Equipment Usage”, although no digital inputs. • Emission reduction plan summary can be useful for a value-based analysis of a new digitisation project, but pre-calculation of the kgCO₂ per action is required. <p><i>Good for calculating physical carbon usage for arts-organisations, suggest combining with other digital-only calculators.</i></p>
<p><u>Carbon Footprint</u></p> <p>Cost: free (for basic features)</p> <p><i>Relevant project phase: project set-up and studio set-up.</i></p>	<ul style="list-style-type: none"> • Provides offerings to different sizes of organisations, ensures reliability and accuracy of results output using Green House Gas (GHG) Protocol (a framework for measuring carbon emissions). • Possibility to add custom inputs with pre-calculated emissions (best if you can calculate the digital components elsewhere). • Requires account to access services. It is possible to pay for more services as needed. <p><i>For medium or large organisations who can invest in their wide range of tools or who have more complex measurement needs.</i></p>

<p><u>Carbon Trust, SME Calculator</u></p> <p>Cost: free</p> <p><i>Relevant project phases: project set-up and studio set-up.</i></p>	<ul style="list-style-type: none"> • Focused on small- and medium-sized enterprises (SMEs), with outputs that give you Scope 1 and Scope 2 emissions breakdown. • Requires some calculation in advance, though this can include digital / customised outputs. • Need to know emission type and amount to perform calculation. <p><i>Best for SMEs with a pre-existing awareness of how to calculate fuel emissions data.</i></p>
<p><u>Creative Climate Tools, Julie's Bicycle</u></p> <p>Cost: free</p> <p><i>Relevant project phases: project set-up (hardware) and studio set-up (office).</i></p>	<ul style="list-style-type: none"> • Offers calculators for buildings and projects specific to the arts industry, with options for reporting and forecasting. • Possible to add custom inputs with pre-calculated emissions (good if you can calculate the digital components elsewhere). • Requires account sign-up but otherwise free to use. <p><i>Good for calculating physical carbon usage for arts-organisations. Suggest combining with other digital-only calculators.</i></p>
<p><u>Ecologi</u></p> <p>Cost: paid for</p> <p><i>Relevant project phases: project set-up and studio set-up.</i></p>	<ul style="list-style-type: none"> • Measures emissions based on “all seven GHGs named by the Kyoto Protocol, CO₂, N₂O, etc.” • Outputs include Scope 1, Scope 2 and Scope 3, but digital is not separated specifically. • Also offer carbon offsetting that you can purchase. • Creating an account is free, but to take advantage of the measurement tools, you need to pay for the “Ecologi Zero” offering. <p><i>For small and large organisations but not tailored to the arts sector or digital.</i></p>

Arts sector carbon calculators

Calculators that measure outputs specific to the art industry, including the production of an artwork, events and exhibition spaces.

Events:

<p><u>The Networked Condition</u></p> <p>Cost: free</p> <p><i>Relevant project phases: digitisation and data storage & preservation (tailored from the digital artwork framework).</i></p>	<ul style="list-style-type: none">• Focused on calculating the carbon footprint for a “livestreamed event, digital artwork or digital event.”• Offers possibility to view the source of the output calculation. <p><i>For individual events or artworks with a digital component.</i></p>
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Exhibition spaces / touring exhibitions:

<p><u>Carbon Calculator – STiCH</u></p> <p>Cost: free</p> <p><i>Relevant project phase: studio set-up (tailored to materials used).</i></p>	<ul style="list-style-type: none">• For measuring specific material used in exhibition spaces.• Requires knowledge of all types of base materials used (chemicals, fabric, cleaning, etc.). <p><i>Best for smaller exhibitions or organisations that can calculate quantity of specific materials used.</i></p>
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Exemplars

Below we include two fictional scenarios that measure the carbon costs of aspects of digitisation projects using calculators in this document. Please use these as inspiration for your own unique organisational needs.

1. Starting a new digitisation project

- To estimate the carbon cost of the energy use of your physical studio set-up (proportionally), use: Carbon Management – Culture for Climate Scotland, Gallery Climate Coalition or Carbon Trust
- To estimate the carbon cost of procuring new hardware, use: Carbon Management – Culture for Climate Scotland
- To estimate the cost of using machine learning for image processing, use: ML CO₂ Impact
- To estimate the carbon cost of storing and preserving the images and data you produce, use: Digital Beacon or Digital Carbon Online

2. Revisiting and rationalising an existing project

- Determine the current carbon cost of your image storage using: Digital Beacon or Digital Carbon Online
- Using the same calculator, compare this to a projected reduced cost based on your imagined rationalised data

This document has been produced by *The Environmental Cost of Digital Technologies in Museums Project* which is supported by the University of St Andrews Impact & Innovation Fund.

This project has been shaped by many members of the museum community, in particular by Eilidh Lawrence and Sean Rippington, to whom we are indebted.

This document benefited greatly from the expertise of our Steering Group. We are very grateful to the following people who invested their time and energy in the project: Stacey Anderson, Rachel Bracha, Amy Cawood, Eddie Martin, Nathan McConway, Lizzie O'Neill, Marjorie Perotto, Claire Whitbread and Matilde Zoppi.

These are living documents. The intense interest in their subject matter dictates constant review as new studies provide further data, approaches and insights. You can expect that all documents produced by *The Environmental Cost of Digital Technologies in Museums Project* will be updated.

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Date: Version 1, May 2026

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