

Cost & Carbon Analysis

For

GreenCloud
Computing Ltd.

Project Ref 1157 - Report v 1.1 Issue Date: 03/06/2025



Executive Summary

Purpose & Methodology

A consultancy exercise was commissioned by GreenCloud Computing Ltd. (GreenCloud) to provide potential customers and investors with an independent evaluation of the cost and carbon implications of their solution. GreenCloud engaged sustainability consultancy P2zero following an introduction via the National Data Centre Academy (NDCA).

To undertake the study P2zero created a model to look at the two main use cases for the GreenCloud solution, which are:

1. to source compute resource from subscriber's PCs at locations powered by sustainable energy or
2. to utilise devices already deployed within an organisation at a time when they are not being use

These use cases were compared with the alternative approaches to obtaining additional compute resource which are to source this from a public cloud provider or to purchase and deploy additional in-house data centre resources.

The modelling compared the costs and the carbon footprint of device energy used (scope 2) and the combination of supply chain energy used plus "embodied" emissions from device manufacture, packaging, transport and end of life treatment (scope 3) for each scenario. The exercise used data from previous P2zero studies on public cloud instances plus data published by manufacturers on the power consumption of devices using standard workloads. The full methodology is presented on pages 4 and 5.

Key Findings

When sourcing compute from subscriber's devices powered by sustainable energy GreenCloud's computing solution delivers:

- a **98%** reduction in carbon emissions and an **80%** cost saving compared with public cloud and
- a **99%** reduction in carbon emissions and a **40%** cost saving compared with additional on-premises data centre resources

When sourcing compute from existing devices within the organisation at times when they are not in use, GreenCloud's computing solution delivers:

- a **2%** reduction in carbon emissions and a **78%** cost saving compared with public cloud and
- a **40%** reduction in carbon emissions and a **36%** cost saving compared with additional on-premises data centre resources

Conclusions

Overall the findings of the study are that the GreenCloud approach to sourcing compute resource is both more sustainable and also much lower cost than conventional on-premises approaches or the latest public cloud services.

Use Case & Scenario Calculations

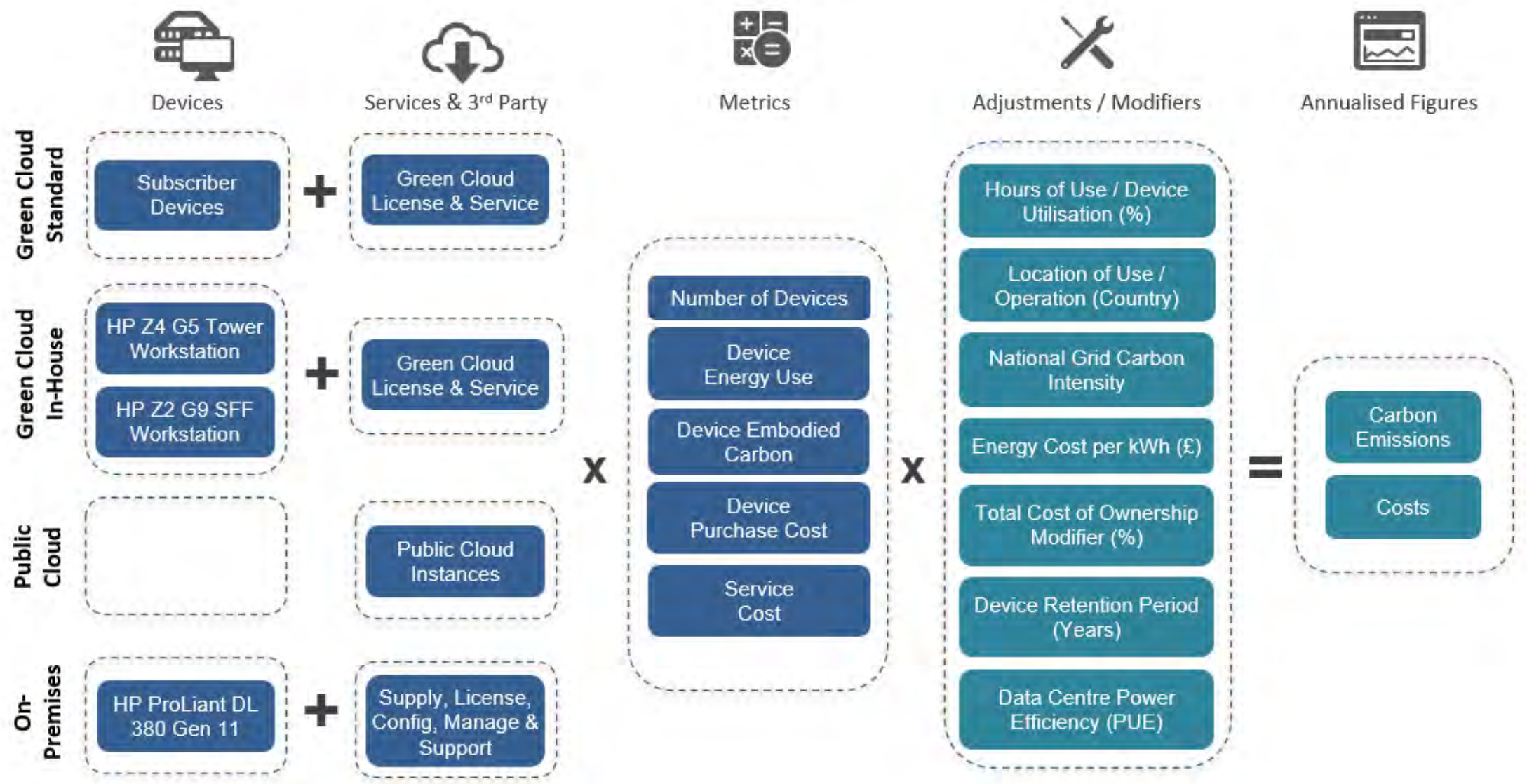
Green Cloud Standard Use Case	Estate Energy & Scope 2		Device & Service Scope 3		Annual Cost & Carbon	
	GCC Cost	Annual Scope 2 (kg CO ₂ e)	Scope 3 per Device (kg CO ₂ e)	Estate Annualised Scope 3 (kg CO ₂ e)	Total Carbon Footprint (kg CO ₂ e)	Cost to Customer
Subscriber Desktops		-	-	-	-	£0
HP ProDesk 800 G6		-	-	-	-	
GreenCloud Service	£10,000	-	-	17	17	£10,000
Total	£10,000	-		-	17	£10,000

GreenCloud In-House Use Case	Estate Energy & Scope 2		Device & Service Scope 3		Annual Cost & Carbon	
	Total Energy Use (kWh)	Annual Scope 2 (kg CO ₂ e)	Scope 3 per Device (kg CO ₂ e)	Estate Annualised Scope 3 (kg CO ₂ e)	Total Carbon Footprint (kg CO ₂ e)	Cost to Customer
HE Workstations						
HP Z4 G5	1,912	396	-	-	396	£468
HP Z2 G9 SFF	1,267	262	-	-	262	£310
GreenCloud Service		0.3	-	17	17	£10,000
Total	3,178	659		-	675	£10,779

Public Cloud Scenario	Estate Energy & Scope 2		Device & Service Scope 3		Annual Cost & Carbon	
	Total Energy Use (kWh)	Annual Scope 2 (kg CO ₂ e)	Scope 3 per Device (kg CO ₂ e)	Estate Annualised Scope 3 (kg CO ₂ e)	Total Carbon Footprint (kg CO ₂ e)	Cost to Customer
Third Party						
Public Cloud	1,989	615	0.005	72	687	£49,950
Total	1,989	615		72	687	£49,950

On Premises Scenario	Estate Energy & Scope 2		Device & Service Scope 3		Annual Cost & Carbon	
	Total Energy Use (kWh)	Annual Scope 2 (kg CO ₂ e)	Scope 3 per Device (kg CO ₂ e)	Estate Annualised Scope 3 (kg CO ₂ e)	Total Carbon Footprint (kg CO ₂ e)	Cost to Customer
On Premises Servers						
Proliant DL380 Gen 11	2,374	492	1,056	634	1,125	£16,782
Total	2,374	492		634	1,125	£16,782

Calculation Schema for Use Cases & Scenarios



Project Approach & Methodology Used

The consultancy exercise is designed to provide a “cost and carbon” comparison of the service offered by GreenCloud with the footprint of alternative solutions which could be purchased and / or used. All of the use cases and scenarios are based on delivering 15,000 hours of high-performance compute (including NVIDIA GPU) in the UK and all device calculations use UK grid conversion metrics for carbon intensity. The public cloud calculation assumes delivery of the service from Ireland.

Analysis of the GreenCloud “Standard” Use Case

The carbon emissions for the standard GreenCloud use case are based on 200 desktop (HP ProDesk 800 G6) devices, plus a proportion of the use of the GreenCloud service. All of the desktop devices were assumed to be 100% powered by renewable energy (a condition of their subscription to the service) so have zero scope 2 emissions. No additional devices are purchased under this use case so there are also zero scope 3 emissions related to the devices. The GreenCloud service energy use and emissions was calculated at UK grid rate pending the deployment of solar power to the National Data Centre Academy where the solution is located. Costs were based on standard license fees for GreenCloud.

Analysis of the GreenCloud “In-House” Use Case

The carbon emissions for the in-house GreenCloud use case are based on 50 tower workstation (HP Z4 G5) and 50 small form factor (HP Z2 G9 SFF) workstations, plus a proportion of the use of the GreenCloud service. All of the desktop devices were assumed to be powered by UK grid energy (although local sustainable energy supply would improve the figures still further) with scope 2 conversion at standard Defra rates for 2024. No additional devices are purchased under this use case so there are also zero scope 3 emissions related to the devices. The GreenCloud service energy use and emissions was calculated at UK grid rate pending the deployment of solar power to the National Data Centre Academy where the solution is located. Costs were based on standard license fees for GreenCloud.

Analysis of the Public Cloud Scenario

The carbon emissions for the Public Cloud scenario are based on the delivery of 15,000 hours of high-performance compute with GPU. As public cloud providers do not provide workload specific energy use or carbon reporting P2zero used the open source BoaVizta tool to provide kWh energy consumption and scope 3 emissions for the instances. The kWh figure was adjusted for a data centre efficiency figure (PUE) supplied by a major public cloud provider with emissions calculated using the Location-Based Method and the Carbon Footprint national conversion metrics for 2024. Server embodied carbon emissions were calculated based on similar server specifications to those in use by major cloud providers, aggregated for assumed years of use. Public cloud costs were based on actual customer billing for these resources in 2024.

Analysis of the On-Premises Server Scenario

The carbon emissions for the On Premises scenario are based on purchasing and deploying sufficient resilient server capacity to deliver the workload. The calculation assumed the purchase, installation, licensing, support, power and maintenance of three servers (HP ProLiant DL380 Gen 11) with two servers active at any time. The kWh figure was adjusted for a typical UK data centre efficiency figure (PUE) with emissions calculated using the Location-Based Method and the Carbon Footprint national conversion metrics for 2024. Server embodied carbon emissions were calculated based on the published lifecycle analysis documents for the specified servers, based on a four year expected lifespan. On-Premises costs were based on typical purchase costs for the specified servers and a TCO uplift factor plus actual energy costs based on commercial rates.

Appendix 1: Definition of Terms

Term	Definition
Carbon Emissions	A combination of the total scope 2 (3 rd party energy use) and scope 3 (embodied carbon) across the customer and services / 3 rd party devices.
Device Embodied Carbon	The manufacturer's statement of carbon dioxide equivalent (Scope 3 CO _{2e}) associated with device resources, manufacture, packaging, shipping & end of life treatment.
Device Retention Period	The number of years that a device of a particular type (e.g. a laptop) is used before replacement.
Device Utilisation	The percentage of time a device would be actively used to deliver the number of hours indicated - note that the standard device utilisation (7.5 hours per day for 220 working days) is 18.84%.
Devices	A server or a computer (laptop, workstation or tablet) or display / monitor used as an End User Computing tool.
Location of Use / Grid Intensity	Conversion of power used (kWh) to carbon dioxide equivalent (Scope 2 CO _{2e}) is based on the carbon intensity of the national grid where consumption occurred.
Location-Based Method	A calculation of CO _{2e} emissions per kWh based on the average carbon intensity of the grid where consumption took place during the period of consumption.
Market-Based Method	A calculation of CO _{2e} emissions per kWh based on the contracts the consumer has in place with energy providers, optionally taking reduction measures such as carbon capture and storage or additive sustainable energy projects into consideration, regardless of the location of consumption.
On-Premises	Provision of services to an organisation from data centres which they own or control.
Public Cloud	The provision of compute and other digital capacity and services by major service providers such as AWS, Google and Microsoft.
PUE	Power Usage Effectiveness - An overall metric for a data centre used to uplift the power consumed by an Instance, accounting for the overheads including cooling.
Scope 2 Emissions	Emissions from the generation of power supplied to the customer by a third party energy are reported as their localised scope 2 CO _{2e} value (Location-Based Method).
Scope 3 Emissions	Emissions from energy used by a supplier in delivering a service plus embodied carbon from device resources, manufacturing, packaging, shipping and end of life treatment and are included whether the device is owned and operated by the customer or as part of a service from their supply chain.
Subscriber	An individual providing one or more devices to GreenCloud on a commercial basis. Subscribers must have high-bandwidth internet services and must power their devices directly using sustainable energy such as solar.
TCO	Total Cost of Ownership Modifier - an uplift to the purchase cost of a device to account for additional costs over its lifetime including support, maintenance and supporting infrastructure / licenses.
Typical Annual Energy Use	The manufacturer's statement of annual power consumption (kWh) under standard management and use conditions.
Workload	The requirement for cloud services which is matched to a particular Instance.

Appendix 2: Supplier Carbon Footprint for this Report

P2zero has committed to a Net Zero target of 2030 for scopes 1, 2 and 3.

We recognise the importance of supply chain to providing customers with transparent reporting of emissions for services and therefore provide a full account of emissions associated with each project and report, as well as an explanation of the methodology used in the calculations.

The total emissions associated with producing this report to date are **10.13 kg CO₂e** covering presales, administration, research, analysis, report production and quality assurance.

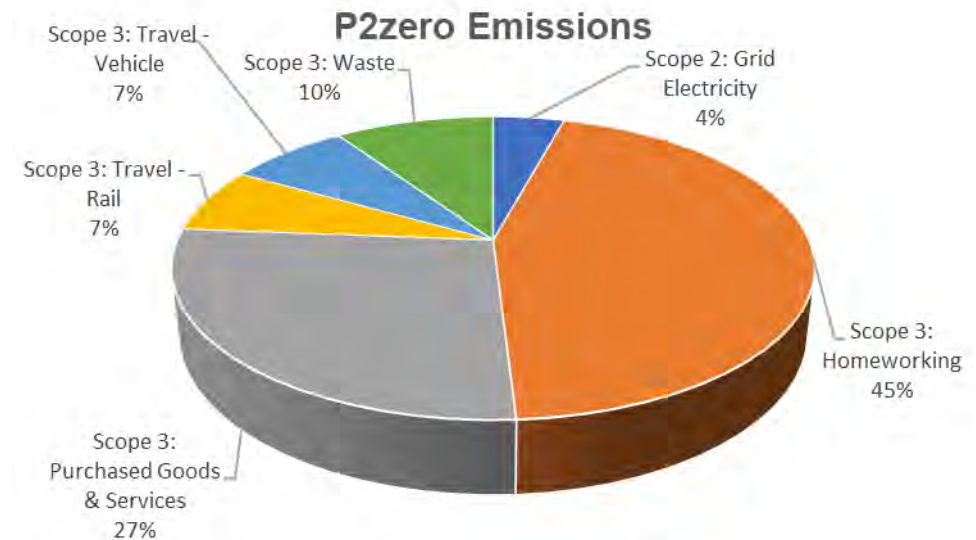
Our figure is calculated from the total annual scope 1, 2 and 3 emissions for the business, divided by the available working days to create a daily “carbon rate” which is then multiplied by the total days used on the project.

The largest individual footprint item for this is from employee homeworking (45%) followed by purchased goods and services (27%) representing the annualised footprint of our IT hardware and use of cloud services.

Our use of homeworking and commitment to use of public transport and electric / hybrid vehicles has kept our emissions for travel and commuting very low (14%).

All figures and conversions are calculated using the latest available UK Government GHG Conversion factors (currently 2024).

A detailed carbon footprint analysis, carbon reduction and net zero plan have been approved by the P2zero board and are available on request.



About P2zero

“We now have the data to put a carbon footprint figure against the devices we provide to our staff and students to enhance our understanding of the estate and its sustainability impact. Strategic partnerships at Imperial are key to delivering change and the partnership with P2zero helps us ensure ICT is fully engaged with the sustainability strategy” **Neil Hanham, Head of Digital Workplace & ICT Sustainability Lead, Imperial College London**

P2zero is an independent IT & sustainability consultancy. Based in the UK and entirely owned by employee shareholders, the company is 100% technology and vendor agnostic. P2zero does not resell product or gain any financial reward from the sale or recommendation of third-party products or services.

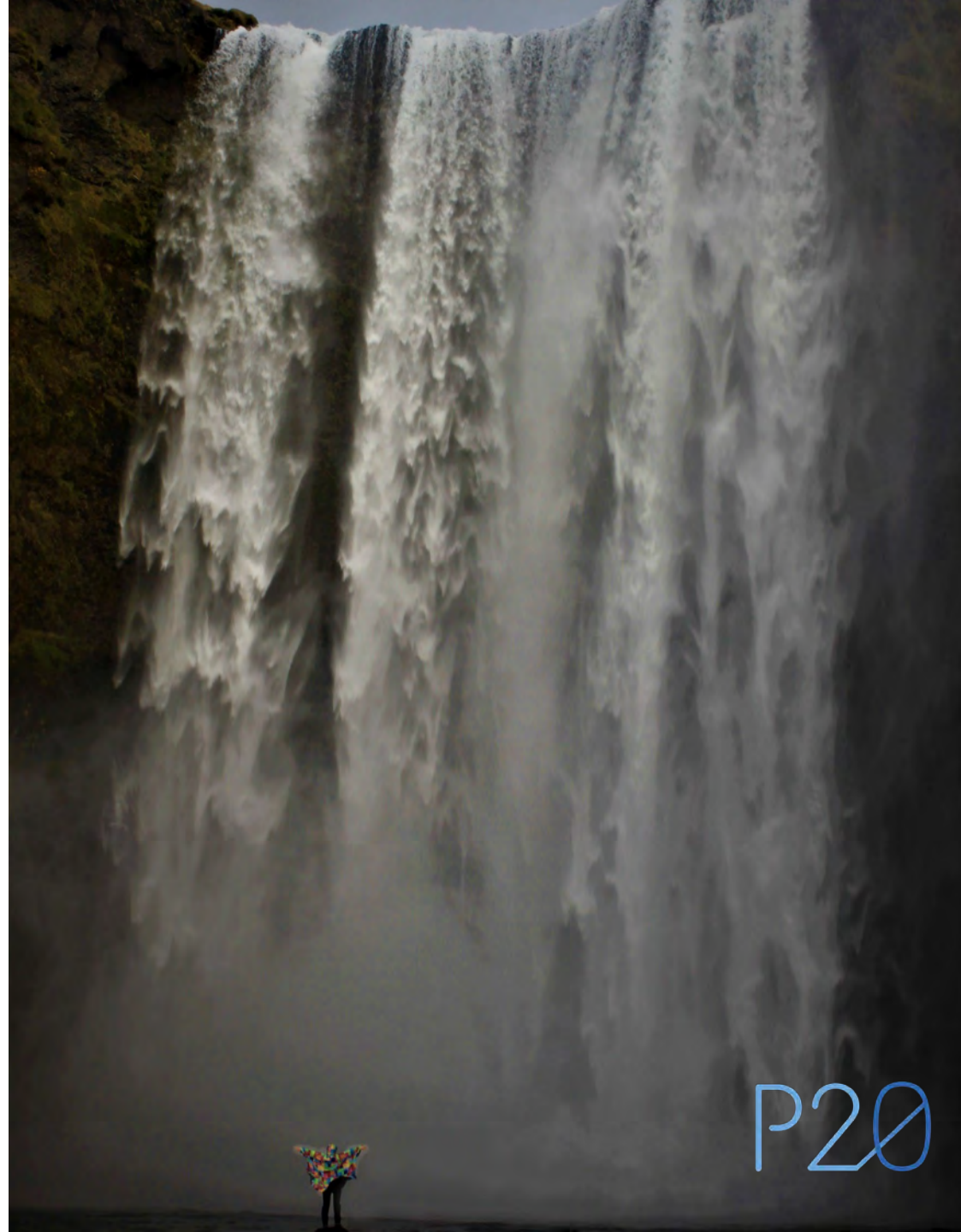
Drawing on a wealth of sustainability, business, economic, design and enterprise IT experience, P2zero brings a unique set of skills to sustainability projects. The team have delivered complex, time-critical projects for a wide variety of clients ranging the world’s leading technology companies to financial institutions, SMEs, local and central government, universities, charities and multi-national businesses.

P2zero’s founder and CEO is Ewen Anderson who holds a Diploma from the Institute of Management Services and was the winner of the 2021 "People Environment Achievement" sustainability award for Digital Technology. Ewen is chair of the UK Government Digital Sustainability Alliance (GDSA) working group on scope 3 emissions across government, with 7.5 years experience in sustainability and 25 years experience in delivering strategic IT consultancy and solutions.

P2zero’s recent sustainability engagements include projects for Imperial College London, AWS, Acer, NatWest, HSBC, Travis Perkins, Teesside University, UCB and PWC. Ewen’s previous sustainability consulting includes reports for M&S, TFL, Astra Zeneca, OVO Energy, Salesforce, Telefonica, the RSPB and the BFI plus multiple central government departments and local authorities.

“The knowledge and information that P2zero has provided us has taken our understanding to a new level and allows us to make much more informed decisions. The team at P2zero are industry leaders in their field and a pleasure to work with.” **Mike Webster, Head of Colleague Platforms & Network Services, NatWest**

More information about P2zero is available at www.p2zero.com



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