



## P2zero Case Study: Measuring the Cost and Carbon of Teesside University's "Cloud Labs"

# Background

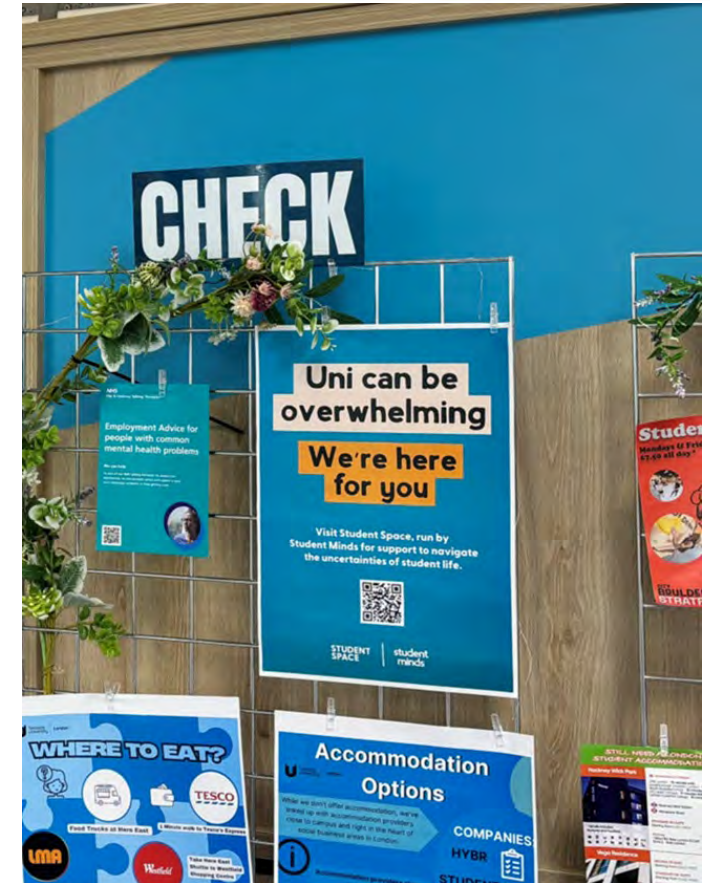
Teesside University is an award-winning University with campuses in both the Tees Valley Teesside (Middlesbrough and Darlington) and London (Stratford), as well as students based overseas. It has over 22,000 students (based on 2021/22 HESA student records) including international students and apprenticeship learners, and over 2,000 staff.

The University has received 'outstanding' praise for its commitment to students – achieving gold in all areas in the Teaching Excellence Framework (TEF) 2023. This included a gold rating for Student Experience as well as Student Outcomes. The TEF is a national quality framework run by the Office for Students which assesses higher education providers across a broad range of criteria – including teaching, course content and delivery, academic support and the learning environment. The University is also rated Ofsted Outstanding for its apprenticeship provision.

Teesside University's values include a commitment to sustainability and the protection of the environment. In 2009 Teesside University achieved the Carbon Trust Standard, the world's first independent carbon award that requires organisations to measure, manage and reduce carbon emissions across their own operations.

In addition, Teesside University has achieved Gold status (originally in 2015 and the latest certification is dated April 2024) from EcoCampus – the leading environmental management system and award scheme for the higher and further education sectors.

When awarded, Malcolm Page, Chief Operating Officer at Teesside University, stated: *'We continuously strive for environmental improvements and are aware of the impact of our operations locally, nationally and internationally. The gold award is a fantastic achievement for the University and a testament to the dedication of our staff who are committed to this very important aspect of our work.'*







## Cloud Labs at the London Campus

For the ICT provision to the labs at the London Campus the University decided to use the AWS AppStream solution.

This allows software to be streamed from the Cloud to any device over an internet connection. This meant that the University did not have to purchase workstation devices for the labs because students could use their own devices.

Having proven that the solution worked well in practice, the University was keen to ensure that the solution was also in line with their sustainability goals before considering any wider use across the Middlesbrough Campus.

The ICT sustainability Assessment summarised within this Case Study demonstrates Teesside University's ongoing commitment to calculate its environmental impact and take measures which will contribute to its strategic commitment to decarbonise the campus.

Following the deployment of the 'Cloud Labs' (powered by AWS AppStream) service in London, Teesside University wanted to compare the costs and carbon emissions of the cloud labs approach with the deployment of physical devices had they been purchased and used.

Furthermore, they wanted to use the findings of the evaluation to explore the potential benefits or disbenefits of applying this approach to the Middlesbrough Campus, therefore helping to inform Teesside University's wider ESG strategy.

AWS, a strategic partner to Teesside University, commissioned specialist sustainability consultancy P2zero to undertake an independent evaluation and report.



## The Project

To initiate the study P2zero evaluated the carbon footprint of device energy on campus (scope 2) and supply chain energy use plus “embodied” emissions from device manufacture, packaging, transport and end of life treatment (scope 3) for devices in each scenario (physical and cloud lab deployment).

This exercise included data on usage of the Cloud Labs service over the year and detailed analysis of workloads during a sample week, combined with outputs from carbon footprint analysis and modelling tools.

P2zero also compared the capital and revenue implications of the two approaches, looking at the costs of purchasing AWS services versus the costs of buying and managing an estate of physical workstations.

It is worth noting that P2zero adopted a “cautious” approach to calculating the figures within this report.

This is reflected in:

- the level of detail requested by P2zero from the University
- the exclusion of staff costs from the model (it is likely that on-site staff would have been required to support the physical labs option) and
- the use of open-source tools by P2zero to independently calculate the scope 2 and 3 emissions data for AppStream.

# Calculating the Sustainability Impacts

From an environmental perspective there were three key differences that P2zero needed to model between the AWS Streaming and physical device scenarios.

Firstly, the AWS Streaming option is “dynamic” meaning that, because they are shared with multiple customers, cloud resources are only used by the University when the service is accessed. In the physical scenario the resources used to create the lab workstations are 100% committed to the University, even if they are never used.

The model therefore needed to compare the resources and scope 3 emissions used in the two scenarios over an annual and six-year period, reflecting how long the University typically keeps devices operational after purchase.

Secondly, the physical devices would have been purchased as a standard workstation model to allow the flexibility to use them to run the software needed for any course. In reality many courses do not require a device of this specification.



The AWS streaming option allows “instances” to be tailored to the course’s software requirements providing a more efficient, right-sized student environment.

To accommodate for this, the model needed to include information on the specific instances being accessed, their frequency of use and the associated computing resources (processor, memory and graphics) provided.



Finally, under the physical scenario, the workstation devices will consume energy on campus creating significant scope 2 emissions even if well-managed and switched off when not in use for long periods (e.g. over a weekend or holiday). In contrast the AWS streaming sessions will only consume energy when used, with any emissions classed as scope 3 (supply chain).

For this scenario the model needed to consider the typical energy consumption of the workstation devices and of the services delivered from AWS, together with the location of the services (for grid carbon-intensity) and the energy-efficiency of the data centre.

From a cost perspective the model examined the purchase, energy and management costs of the workstation devices versus the annual costs of the AWS AppStream service.

Taking the “cautious” approach P2zero included the costs (and environmental overheads) of 24 loan HP laptops purchased for the London Campus which were also included in the AWS AppStream scenario, even though these are a shared resource across all students on the campus rather than specifically for lab use.

Once the model had been created for the London Campus P2zero examined the current devices and usage of the labs on the Middlesbrough Campus. The make, model, energy consumption and scope 2 and 3 carbon footprint of over 1,100 lab devices was analysed and compared with the AWS AppStream instances needed to deliver the equivalent of the London service, scaled up to meet the requirements of the Middlesbrough Campus.





## The Results

### Sustainability Savings:

Calculating these differences, P2zero found that the Cloud Labs option for the **London Campus** delivered a saving of:

- 78% on scope 2 emissions (from University energy use) and
- 25% on scope 3 emissions (from supply chain energy use and device embodied carbon).

### Cost Savings:

Overall, this provides an annual cost saving (covering devices and energy use) of:

- 28% versus the physical device option.

Taken over the expected **six-year** lifespan of the Teesside University devices, the Cloud Labs solution for the London Campus would save the equivalent of driving an average car **90% of the way around the world.**

Applying the London calculations to the **Middlesbrough Campus** indicated the potential for:

- a saving of **76%** on scope 2 emissions (from University energy use) and 24% on scope 3 emissions (from supply chain energy use and device embodied carbon)
- an overall annual cost saving of **26%** vs the physical device option

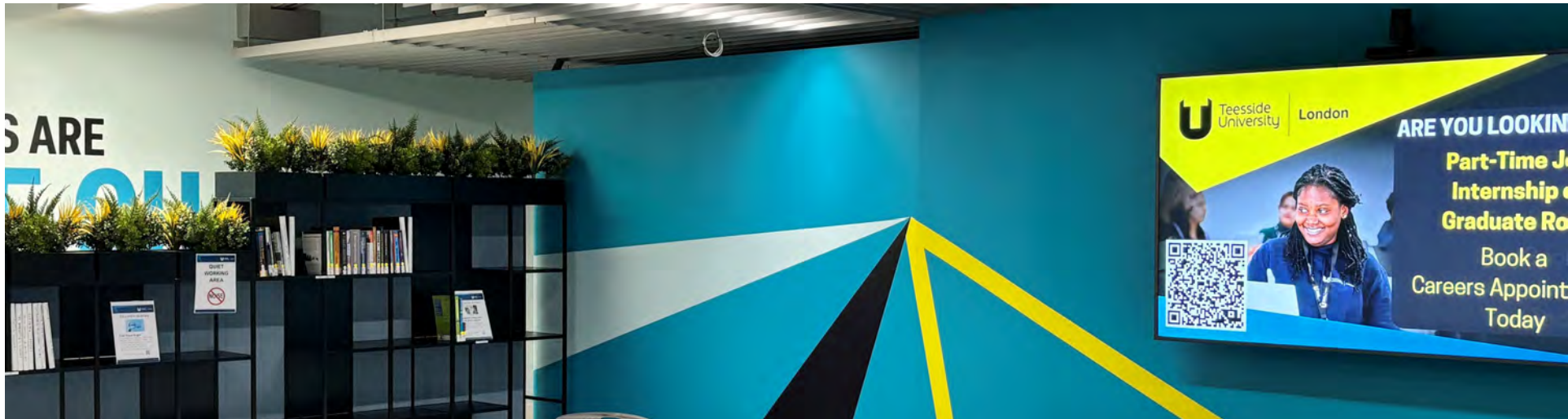
# Project Feedback

On completion of this IT Sustainability Assessment, **Paul Dalkin, Head of IT Device Services, IT & Digital Services, Teesside University** commented:

*"P2zero gave us valuable insights into the outliers and practices of parts of our hardware estate, of which we were simply not aware.*

*They also did a careful deep dive with our cloud service providers and provided much-needed steers on industry good practice in the interpretation of usage data. Their analysis and attention to detail is both robust and fiercely objective – and their transparency was demonstrated by the inclusion of the Carbon footprint of the project itself in the report!*

*P2zero were a pleasure to work with, and this valuable analysis will enable us to inform and progress the sustainability and environmental agendas at Teesside."*



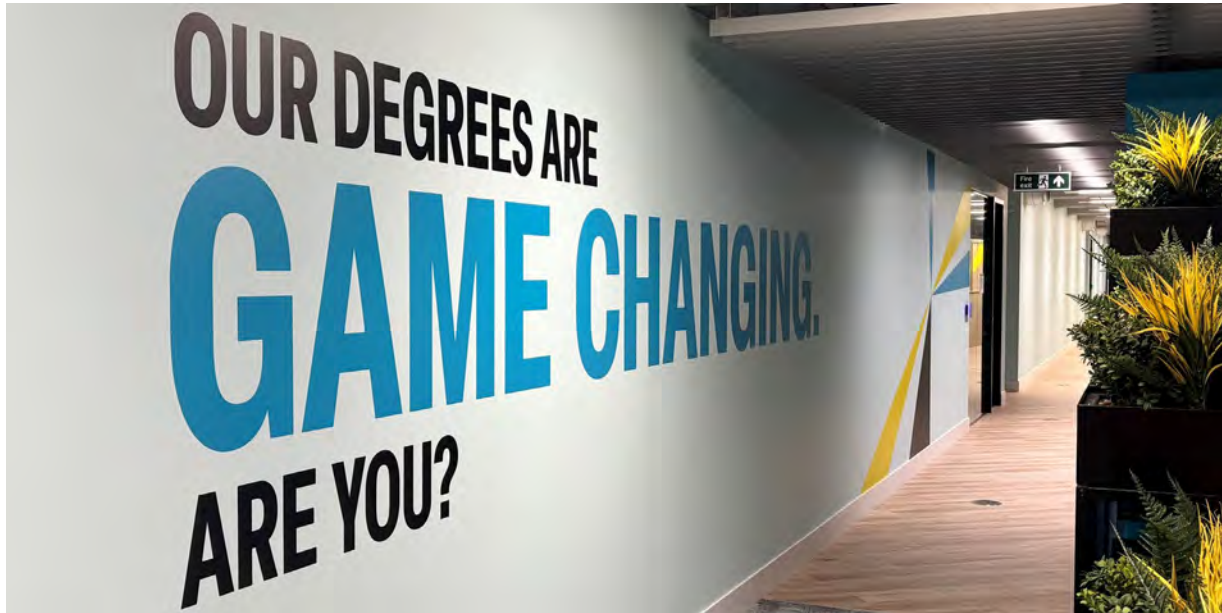


# Conclusions

The study concluded that the “dynamic” approach of providing resources on-demand via AWS AppStream has significant cost and environmental benefits compared with providing physical workstation devices in labs. The approach reduces carbon emissions by significantly lowering overall energy consumption and by removing the need to have dedicated workstation devices largely unused in the labs.

This is particularly beneficial from an environmental and cost perspective when applied to lab environments where devices may be used infrequently, however further modelling would be required to determine whether the savings also apply to other shared devices on campus (e.g. in libraries) which may be of a lower specification and more frequently used.

It was also noted that the Cloud Labs solution offers additional benefits through flexibility and equality of access (allowing courses to be delivered to any location and device) and simplification of service provision (allowing the labs to operate without dedicated on-site IT staff).



**Ewen Anderson, CEO at P2zero** commented on the project *“It is really important that organisations consider cost and carbon, including the carbon emissions of their supply chain, when making strategic decisions. Teesside have taken care to get an independent assessment to confirm that the solution for their London Labs is the more sustainable solution before considering any wider adoption.”*

Through the study Teesside University has now confirmed that the “cost and carbon” of the Cloud Labs project is in line with the University’s net zero strategy and may provide a model for wider use across the Middlesbrough Campus.