# ARCHER2
# SP Quarterly Report

October – December 2025

EPCC
The University of Edinburgh

# Document Information and Version History

| | |
|---|---|
| **Version:** | 1.0 |
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| **Author(s):** | Clair Barrass, Jo Beech-Brandt, Alan Simpson, Anne Whiting |
| **Reviewer(s)** | Alan Simpson |

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| 0.1 | 08/12/2026 | Template created | Jo Beech-Brandt |
| 0.2 | | Added narrative, graphs, service statistics | Jo Beech-Brandt |
| 0.3 | 06/01/2026 | Added critical success metrics | Lorna Smith |
| 0.4 | 06/01/2026 | Added compliance related information | Anne Whiting |
| 0.5 | 07/01/2026 | Reviewed | Alan Simpson |
| 1.0 | 14/01/2026 | Version for UKRI | Alan Simpson, Jo Beech-Brandt |

# 1 The ARCHER2 Service

This is the report for the ARCHER2 SP Service for the Reporting Period: 1 October – 31 December 2025.

## 1.1 Service Highlights

- Utilisation remains high with the overall utilisation at 94% during this quarter which included the festive period where we have previously sometimes seen dips in utilisation. The monthly utilisations figures were 92% in October, 94% in November and 96% in December.

- The ARCHER2 Management Board approved the Operating System update work following the positive response received by the options paper at the User Advisory Group. The system software on all user-facing ARCHER2 nodes (login nodes, data analysis nodes, and compute nodes) was updated via a rolling reboot to a version of SUSE Linux Enterprise Server (SLES 15 SP4) that is decoupled from the HPE Cray sources. The HPE Cray Programming Environment (CPE) was also updated from 22.12 to 23.09. Users were notified and documentation was revised. This software change allows ARCHER2 to continue to receive critical security updates for the remainder of its lifetime and took place with minimal user interruption to service.

- ARCHER2 staff attended and represented the service at various meeting including HPC-AI, DRI Congress, HPC-SIG, international SuperComputing25 and CIUK. Daniel Gleed took the opportunity to promote the System Administrator course at the HPC-SIG meeting at CIUK, and Paul Clark also presented on the switchgear replacement work at the HPC-SIG held at the Hartree Centre.

- The Terms and Conditions of access to ARCHER2 were updated to include the requirements to comply with the UKRI Trusted Research policy and that of their academic institution. A requirement was also added to comply with all relevant export control laws and regulations, and details provided of what this means. Users were then asked to review and re-sign that they had read and understood the terms and conditions of access.

- EPCC passed our annual Cyber Essential assessment, which helps to ensure we comply with best practice for cybersecurity for ARCHER2 and the other services we run.

- A change freeze was approved over the festive period and this proved to be successful again. As can be seen from the report, utilisation remained high and all service metrics were met. An issue with quotas on one of the work file systems was identified and a workaround was put in place. Users were notified that the required change has now been scheduled and will take place in mid-January 2025.

- Approved projects from the recent Access to HPC Call have either been set up on the system or their PIs have been reminded to complete a Technical Assessment within SAFE so we can get the project onboarded.

## 1.2 Forward Look

- Planning is taking place for additional capability days to take place over the remainder of the lifetime of the ARCHER2 service. This will allow users the opportunity to test and run codes at large scale.

- EPCC continue to work with HPE towards the deployment of a server running "View for Clusterstor" software. This should enable better understanding of work file system performance and a more immediate ability to identify the origin of problems on work file systems. EPCC have configured and provided a server for HPE to use for this deployment and HPE aims to get this software running during 2Q2026. .

- EPCC have also been working closely with HPE to implement PowerSched on ARCHER2. Following initial testing, HLRS developers proposed changes to both the software and the configuration and these changes have now been implemented. A second round of PowerSched performance testing will be undertaken in collaboration with HPE and HLRS during 1Q 2026.

- A site review is being conducted with the newly appointed University of Edinburgh estates project manager. This will involve reviewing critical works before looking at the cooling infrastructure across the site. Given weather trends, there is an expectation of increased temperatures during summer periods and in view of this we are continuing to improve our understanding and our processes around hot weather mitigation to services and supporting plant.

- We have started preliminary work to expand our ISO certification with a 14001 certification which is the international standard for environmental management. This provides a framework for organisations to manage their environmental responsibilities, reduce impact (like waste, energy use, pollutants), ensure legal compliance, and continuously improve their environmental performance. This is particularly relevant for the ACF datacentre where we want to ensure we minimise the potential environmental impact of running such a resource intensive site.

- EPCC are working to integrate file system awareness into the Slurm scheduler, in order to allow individual file systems to be taken down for maintenance with less impact to users. This should reduce the overall unavailability for users of specific file systems to only the specific time where maintenance is conducted.

- A User Forum is planned as part of the annual Celebration of Science event. This will allow ARCHER2 staff to provide updates and also gain feedback directly from the User Forum. This event will be hybrid to allow users unable to attend the Celebration of Science to participate.

- Planning for the end of service (currently scheduled for 21 November 2026) will start during this quarter and EPCC will be working closely with UKRI to ensure timely, accurate messaging is sent to users.

# 2 ARCHER2 Performance Report

This is the contractual performance report for the ARCHER2 SP Service for the Reporting Periods from 1 October until 31 December 2025.

## 2.1 Service Points and Service Credits

The Service Levels and Service Points for the SP service are defined by EPSRC in Schedule 2.2 of ARCHER2 SP Service Contract.

The Working Day (WD) for the ARCHER2 Service is 10 Working Hours (WH) as the Service operates from 0800-1800. The Median Time to Resolution is measured in WD.

- **Availability**: *Service Threshold: <=96.5%; Operating Service Level: >98.0%, ≤ 98.5%.*
- **ARCHER2_SP_Level1 (MTR)**: The Median Time to Resolution, of all SP queries falling within Level 1 resolved by the Contractor in the Reporting Period. *MTR Service Threshold: >1 WD; Operating Service Level: >0.3 WD, ≤ 0.45 WD.*
- **ARCHER2_SP_Level2 (MTR)**: The Median Time to Resolution, of all SP queries falling within Level 2 resolved by the Contractor in the Reporting Period. *MTR Service Threshold: >8 WD; Operating Service Level: >2 WD, ≤4 WD.*
- **ARCHER2_SP_Level3 (MTR)**: The Median Time to Resolution, of all SP queries falling within Level 3 resolved by the Contractor in the Reporting Period. *MTR Service Threshold: >25 WD; Operating Service Level: >12 WD, ≤16 WD.*
- **Initial Response to Queries (%):** The percentage of the total number of SP queries assigned to the Contractor in the Reporting Period responded to within 3 Working Hours. *Service Threshold: <96.00%; Operating Service Level: 98.00 – 98.99%.*
- **Query User Satisfaction (%):** The percentage of the total number of query satisfaction surveys completed in each Reporting Period, rating the quality of the resolution of Queries by the Contractor as "Good", "Very Good" or "Excellent". *Operating Service Level: 82.00 – 87.99%*

### 2.1.1 Service Points

| Metric | Oct 2025 | | Nov 2025 | | Dec 2025 | | Q4 2025 | |
|---|---|---|---|---|---|---|---|---|
| | **Perf** | **Points** | **Perf** | **Points** | **Perf** | **Points** | **Perf** | **Points** |
| Availability | 99.9% | -2 | 100% | -3 | 100% | -3 | 99.9% | **-8** |
| SP_Level1 (MTR) | 0.00 | -2 | 0.00 | -2 | 0.00 | -2 | **0.00** | **-6** |
| SP_Level2 (MTR) | 0.08 | -2 | 0.07 | -2 | 0.07 | -2 | **0.07** | **-6** |
| SP_Level3 (MTR) | 5.57 | -2 | 0.00 | -2 | 0.00 | -2 | **5.57** | **-6** |
| Initial Response (%) | 100% | -1 | 100% | -1 | 100% | -1 | **100%** | **-3** |
| Query Satisfaction (%) | 100% | -2 | 100% | -2 | 100% | -2 | **100%** | **-6** |
| **Total** | | **-11** | | **-12** | | **-12** | | **-35** |

### 2.1.2 Service Credits

As the Total Service Points are negative (-35.0), no Service Credits apply in 4Q25.

## 2.2 SP Query Statistics

The metrics were specified by EPSRC in Schedule 2.2 of ARCHER2 SP Service Contract.

- **Assigned:** The number of SP queries assigned to the Contractor within each query resolution category in the Reporting Period.
- **Resolved:** The number of SP queries resolved by the Contractor within each query resolution category in the Reporting Period.
- **Backlog:** The number of SP queries assigned to the Contractor that remained unsolved within each query resolution category in the Reporting Period
- **Correspondence:** The average number of pieces of correspondence generated for SP queries in each query resolution category.
- **First Response:** The average time taken for the Contractor to first respond to the Originator of the SP query.

| **October 2025** | | | | | |
|---|---|---|---|---|---|
| **Service level** | **Assigned** | **Resolved** | **Backlog** | **Correspondence** | **First Response** |
| SP_Level1 | 4721 | 4721 | 0 | 0.12 | 0:02:54 |
| SP_Level2 | 116 | 121 | 10 | 6.9 | 0:15:35 |
| SP_Level3 | 1 | 2 | 0 | 13 | 0:15:38 |
| **November 2025** | | | | | |
| **Service level** | **Assigned** | **Resolved** | **Backlog** | **Correspondence** | **First Response** |
| SP_Level1 | 6145 | 6145 | 0 | 0.053 | 0:03:47 |
| SP_Level2 | 96 | 94 | 19 | 7.4 | 0:15:37 |
| SP_Level3 | 2 | 0 | 1 | 0 | 0:00:00 |
| **December 2025** | | | | | |
| **Service level** | **Assigned** | **Resolved** | **Backlog** | **Correspondence** | **First Response** |
| SP_Level1 | 1938 | 1938 | 0 | 0.12 | 0:00:23 |
| SP_Level2 | 70 | 62 | 21 | 7.3 | 0:11:45 |
| SP_Level3 | 1 | 0 | 1 | 0 | 0:00:00 |
| **Q4 2025** | | | | | |
| **Service level** | **Assigned** | **Resolved** | **Backlog** | **Correspondence** | **First Response** |
| SP_Level1 | 12804 | 12804 | 0 | 0.088 | 0:02:55 |
| SP_Level2 | 283 | 277 | 21 | 7.2 | 0:14:44 |
| SP_Level3 | 2 | 2 | 1 | 13 | 0:15:38 |

## 2.3 Query Resolution

| **Metric** | **Oct 2025** | | **Nov 2025** | | **Dec 2025** | | **Q4 2025** | |
|---|---|---|---|---|---|---|---|---|
| **Service Level** | **MTR** | **Resolved** | **MTR** | **Resolved** | **MTR** | **Resolved** | **MTR** | **Resolved** |
| SP_Level1 | 0:00:20 | 4721 | 0:00:29 | 6145 | 0:00:10 | 1938 | 0:00:23 | 12804 |
| SP_Level2 | 0:49:05 | 121 | 0:41:41 | 94 | 0:42:32 | 62 | 0:44:13 | 277 |
| SP_Level3 | 55:44:51 | 2 | 0:00:00 | 0 | 0:00:00 | 0 | 55:44:51 | 2 |
| **Total** | | **4844** | | **6239** | | **2000** | | **13083** |

A total of 13083 queries were resolved by the ARCHER2 SP Service in the Reporting Period. The percentage of user queries responded to within 3 hours was 100%.

## 2.4 Query Feedback

During October, there were 33 feedback scores received during this period. 100% were Good, Very Good or Excellent with 79% given the highest score of Excellent.

During November, there were 19 feedback scores received during this period. 100% were Good, Very Good or Excellent with 100% given the highest score of Excellent.

During December, there were 12 feedback scores received during this period. 100% were Good, Very Good or Excellent with 100% given the highest score of Excellent.

£64 donation was made to our chosen charity Save the Children with £1 donated per query feedback item received.

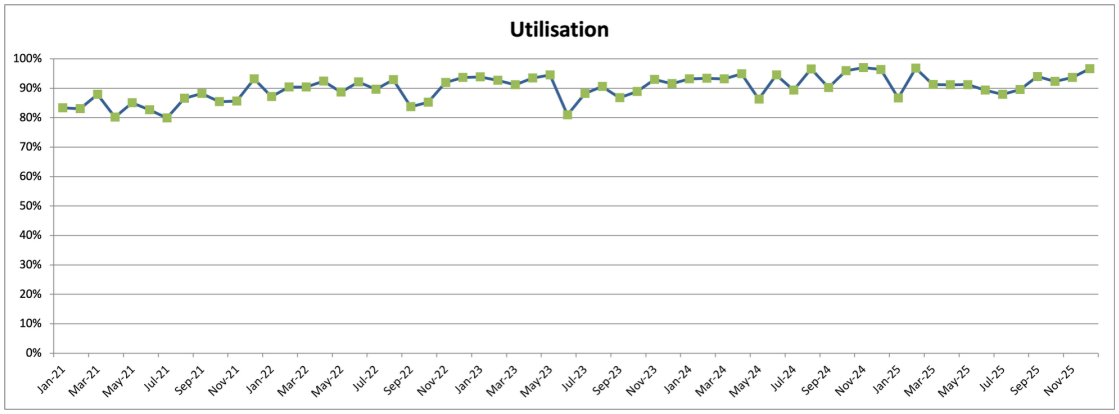
## 2.5 Maintenance and Outages

| Type | Start | End | Duration | User Impact | Reason | Attributable |
|---|---|---|---|---|---|---|
| Partial | 2025-10-16 0830 | 2025-10-16 0930 | 60 mins | Interruption to login node availability | Login node OS Update | HPE |
| Partial | 2025-10-08 1120 | 2025-10-11 1144 | 24 mins | /work filesystem unavailable | Network disruption and knock-on filesystem issue | SP |

# 3 ARCHER2 Service Statistics

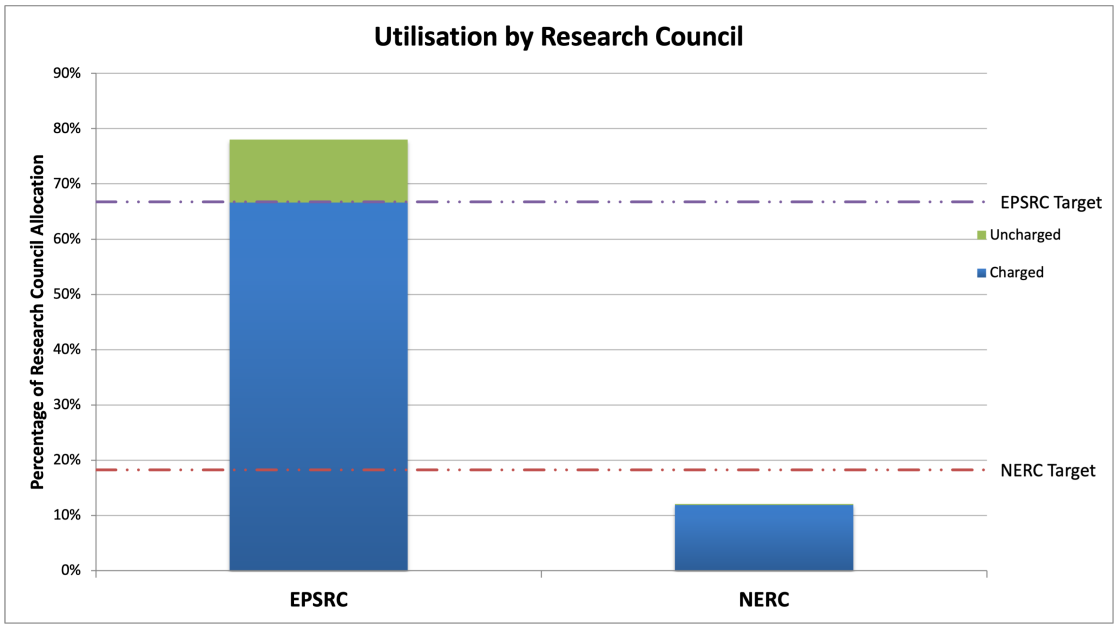
## 3.1 Utilisation

The utilisation for ARCHER2 remains high for 1 October – 31 December at 94% which compares with last quarter which was 90%. Utilisation for October was 92%, for November 94% and for December 96%.

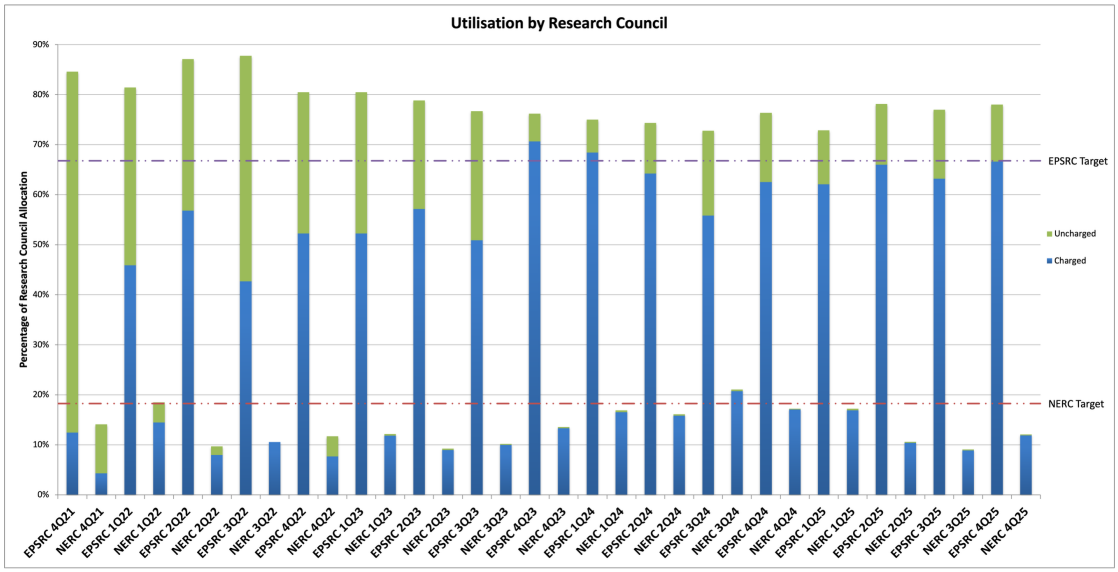



The utilisation by the Research Councils, relative to their respective allocations, is presented below. This bar chart shows the usage of ARCHER2 by the two Research Councils presented as a percentage of the total Research Council allocation on ARCHER2. It can be seen that EPSRC exceeded their target this quarter with their usage being at 78% (against their target of 66.8%). It should also be noted that the proportion of EPSRC's uncharged utilisation has decreased this quarter from 13.8% in 3Q25 to 11.4% in this quarter.

NERC did not meet their target utilisation of 18.2% but their utilisation increased to 12% (from 9% in 3Q25).




The stacked graph below shows the trend of charge and uncharged utilisation since the start of the service.


Utilisation by Research Council
Percentage of Research Council Allocation
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
EPSRC Target
NERC Target
Uncharged
Charged
EPSRC 4Q21
NERC 4Q21
EPSRC 1Q22
NERC 1Q22
EPSRC 2Q22
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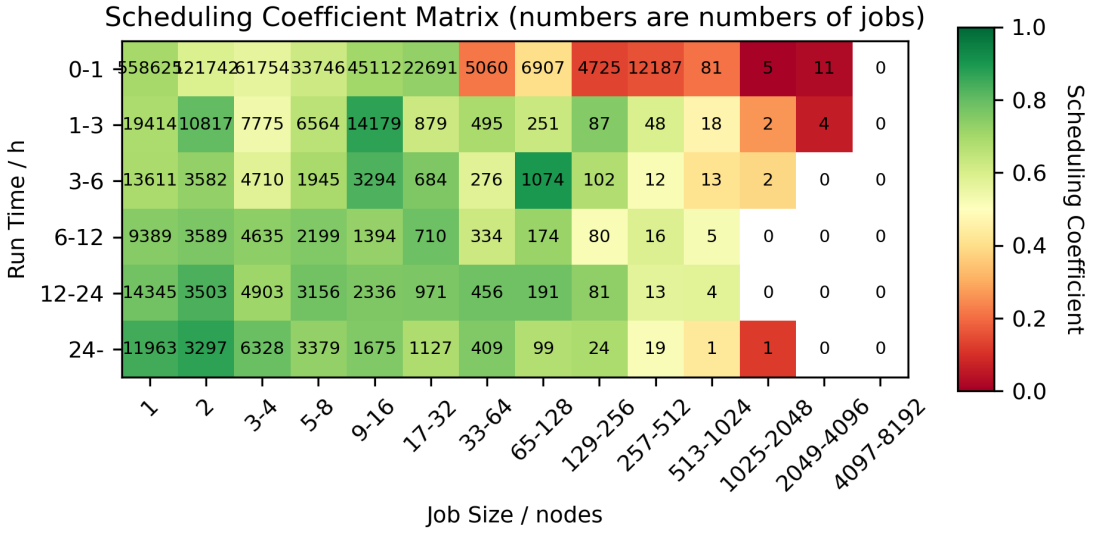
EPSRC 4Q25
NERC 4Q25

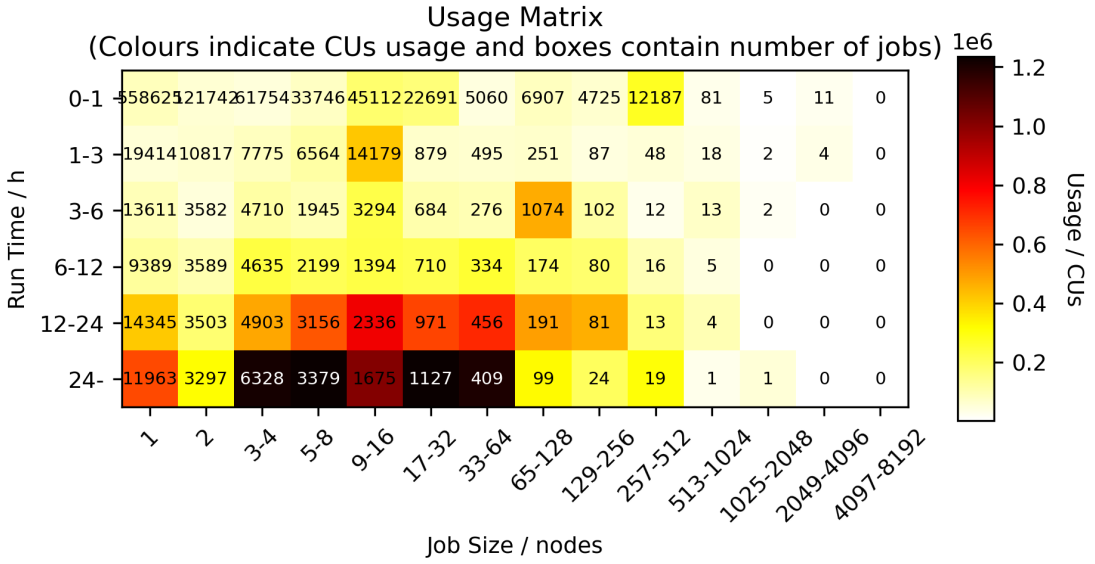
## 3.2 Scheduling Coefficient Matrix

The colour in the matrix indicates the value of the Scheduling Coefficient. This is defined as the ratio of runtime to runtime plus wait time. Hence, a value of 1 (green) indicates that a job ran with no time waiting in the queue, a value of 0.5 (pale yellow) indicates a job queued for the same amount of time that it ran, and anything below 0.5 (orange to red) indicates that a job queued for longer than it ran.




The usage heatmap below provides an overview of the usage on ARCHER2 over the quarter for different job sizes/lengths. The colour in the heatmap indicates the number of CUs expended for each class, and the number in the box is the number of jobs of that class.

It should be noted that there was an increase in the number of larger sized jobs during this quarter as users were encouraged to submit larger jobs during the data centre network maintenance session.



# Appendix: Critical Success Factors

## 1. Context

EPCC have been asked by UKRI to provide quarterly data for a number of critical success factors:

- CSF04 Implementation of environmentally considerate energy policies
- CSF07 Deliver and maintain a reliable data I/O function
- CSF08 Be cost-effective, cost-efficient and drive towards lowering of operational costs

In the sections below, please find the relevant metrics and data.

## 2. CSF04 Implementation of environmentally considerate energy policies

*Implementation of environmentally considerate energy policies with a drive to reducing costs and environmental impacts.*

All electricity provided to the ACF and ARCHER2 is on a 100% green, renewable energy tariff.

**Environmentally considerate policies: 4**

Since the start of full Service, EPCC have worked on implementing the following policies:

- Move from High Performance Mode to Low Power Mode: reduced average power draw from 3.2 MW to 2.9 MW (9%) with negligible input on performance [May 2022]
- Reduced default processor frequency: further reduced average power to around 2.5 MW (19%) [December 2022]
- Increase in coolant temperatures: this will result in an increase in passive cooling ("free cooling") [ongoing]
- Developed a set of new tools to help users estimate the environmental impact of their computing simulations and workloads [November 2024]

**Power Usage**

| | **4Q 21*** | **1Q 22** | **2Q 22** | **3Q 22** | **4Q 22** | **1Q 23** | **2Q 23** | **3Q 23** | **4Q 23** |
|---|---|---|---|---|---|---|---|---|---|
| **Average Power** | 3.31 | 3.16 | 3.15 | 2.86 | 2.90 | 2.51 | 2.56 | 2.46 | 2.53 |
| | **1Q 24** | **2Q 24** | **3Q 24** | **4Q 24** | **1Q 25** | **2Q 25** | **3Q 25**** | **4Q25**** | |
| **Average Power** | 2.58 | 2.54 | 2.64 | 2.57 | 2.55 | 2.55 | 2.52 | 2.54 | |

* Partial

**Does not include period of site downtime

So far, the average power draw has been reduced by around 0.7MW (21%) which will reduce electricity usage by up to 6M kWh per annum, significantly reducing annual running costs.

# 3. CSF07 Deliver and maintain a reliable data I/O function

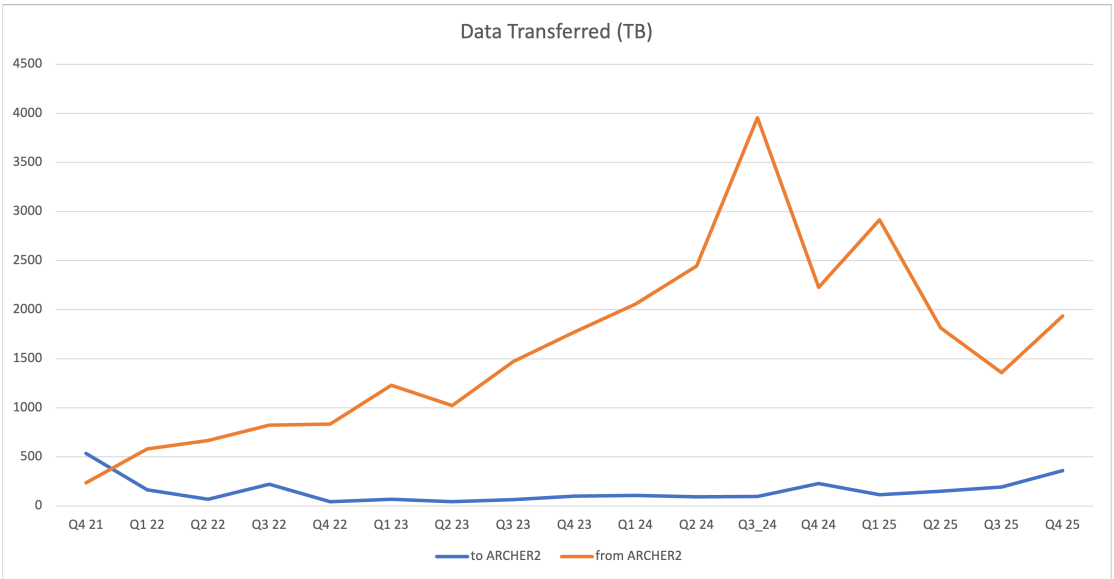
*The compute resource will deliver and maintain an efficient, effective and reliable data I/O function which meets the requirements of users and their software. It will evolve and expand to accommodate new software or hardware architectures as required by the Service or its user base.*

**Data Transferred**

EPCC monitor the data transfer rates in and out of the ARCHER2 system. Based on this, we now estimate the total amount of data transferred on and off ARCHER2 each Quarter.

| Data Transferred… | **4Q21*** | **1Q22** | **2Q22** | **3Q22** | **4Q22** | **1Q23** | **2Q23** | **3Q23** | **4Q23** |
|---|---|---|---|---|---|---|---|---|---|
| **…to** ARCHER2 (TB) | 534 | 163 | 68 | 220 | 44 | 67 | 42 | 65 | 99 |
| …**from** ARCHER2 (TB) | 236 | 582 | 667 | 822 | 834 | 1231 | 1022 | 1472 | 1771 |
| Data Transferred… | **1Q24** | **2Q24** | **3Q24** | **4Q24** | **1Q25** | **2Q25** | **3Q25** | **4Q25** | |
| …**to** ARCHER2 (TB) | 108 | 93 | 98 | 228 | 114 | 150 | 191 | 361 | |
| …**from** ARCHER2 (TB) | 2056 | 2443 | 3956 | 2227 | 2915 | 1815 | 1359 | 1934 | |

* Partial




The amount of data moved off ARCHER2 has increased from the previous quarter.

## Parallel IO write performance

We regularly monitor the parallel write performance between the compute nodes and the parallel Lustre (/work) file systems. We use the benchio synthetic IO benchmark application[1] and report the MPI-IO write performance with the following settings:

- Global data structure of $2048^3$: writes a single file of 65,536 MiB (64 GiB).
- Uses 16 compute nodes and 128 MPI processes per node.
- Uses UCX as the MPI transport protocol.
- Sets the following environment variables:
  - FI_OFI_RXM_SAR_LIMIT=64K
  - MPICH_MPIIO_HINTS="*:cray_cb_write_lock_mode=2,*:cray_cb_nodes_multiplier=4”

These settings have been found to maximise the IO performance for parallel writes using MPI-IO on the ARCHER2 file systems. Writes using the default settings on ARCHER2 typically have median write values 2-3 GiB/s lower than the optimised values.

Original reporting of this data (Q1 and Q2 2023) used the means from a small number of runs on the HDD-based Lustre file systems. From Q3 2023 onwards we have been monitoring performance regularly on both HDD and NVMe-based Lustre file systems throughout the quarter and report median (Q2) and lower (Q1) and upper quartile (Q3) performance and provide boxplots illustrating the performance variation. (On the boxplots, the green triangles mark the mean value and the whiskers extend to the last datapoint within the range 1.5 x IQR.)

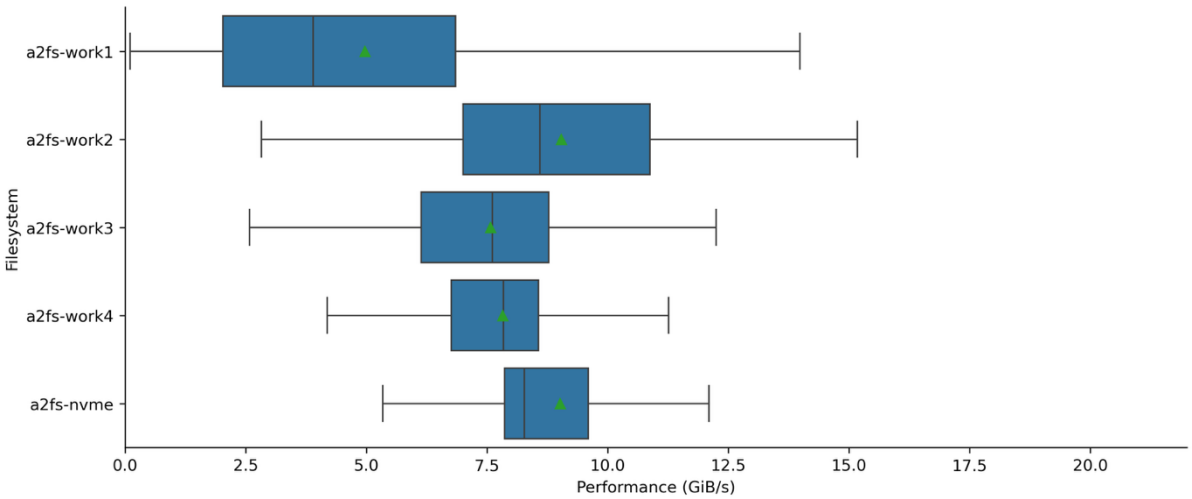
During Q1 2025, we have worked to remove data from a2fs-work1 as much as possible. With the usage of the file system now below 80% we see a significant improvement in performance compared to Q4 2024 where the usage on the file system was over 80%. We are working to ensure that usage on any of the ARCHER2 Lustre file systems does not go above 80% to try and maintain good performance for users on the service.

Lower performance of a2fs-work1 during 4Q 2024 and 4Q 2025 are both attributed to usage levels moving close to or beyond 80% of total file system capacity leading to less efficient data storage.

[1] https://github.com/davidhenty/benchio

| Benchio MPI-IO medium (GiB/s) | 1Q23 | 2Q23 | | 3Q23 | 4Q23 | 1Q24 | 2Q24 | 3Q24 | 4Q24 |
|---|---|---|---|---|---|---|---|---|---|
| a2fs-work1 | 8.2 | 7.6±0.5 | | 10.5 (8.8:11.8) | 10.9 (8.3:12.5) | | 10.1 (7.0:11.8) | 9.7 (6.7:11.9) | 4.0 (2.0:9.6) |
| a2fs-work2 | 8.5 | 7.3±0.6 | | 10.4 (7.2:12.4) | 10.4 (7.7:13.0) | | 11.1 (8.0:12.5) | 11.1 (8.1:13.1) | 11.3 (7.1:15.0) |
| a2fs-work3 | 8.3 | 9.6±0.7 | | 10.0 (8.2:11.6) | 10.7 (8.1:11.9) | | 9.6 (8.4:11.8) | 9.6 (7.5:11.8) | 9.3 (7.0:11.6) |
| a2fs-work4 | | | | | 9.7 (9.1:10.2) | | 10.0 (9.2:10.8) | 10.6 (9.4:11.6) | 10.7 (9.5:11.7) |
| a2fs-nvme | | | | 10.1 (9.6:11.5) | 10.1 (9.5:12.4) | | 11.1 (10.5:12.4) | 11.6 (11.1:12.7) | 10.7 (10.0:11.8) |

| Benchio MPI-IO medium (GiB/s) | 1Q25 | 2Q25 | 3Q25 | 4Q25 |
|---|---|---|---|---|
| a2fs-work1 | 8.6 (5.0:11.1) | 8.6 (6.4:11.7) | 7.5 (4.9:9.7) | 3.9 (2.0:6.8) |
| a2fs-work2 | 10.7 (8.1:12.7) | 11.4 (8.9:12.6) | 10.3 (8.1:12.0) | 8.6 (7.0:10.9) |
| a2fs-work3 | 9.3 (7.7:11.6) | 9.5 (7.3:11.7) | 8.8 (7.2:10.6) | 7.6 (6.1:8.8) |
| a2fs-work4 | 10.1 (8.8:10.9) | 10.5 (9.0:11.3) | 9.5 (7.8:10.5) | 7.8 (6.8:8.6) |
| a2fs-nvme | 11.3 (10.4:13.3) | 11.0 (10.4:13.5) | 10.9 (10.4:13.1) | 8.3 (7.9:9.6) |



# 4. CSF08 Be cost-effective, cost-efficient and drive towards lowering of operational costs

*The Service shall be cost-effective and cost-efficient across its elements during its lifetime and drive towards lowering of operational costs by seeking efficiencies in delivery such that TCO presents an acceptable and cost-effective solution for the public. The Service will monitor and report its Power Usage Effectiveness (PUE) and strive to make efficiency savings where possible.*

**Relative Research Output**

| **Measure** | 11/2021 – 5/2022 | 5/2022 – 12/2022 | 01/2023 – 12/2023 | 1Q 24 | 2Q 24 | 3Q 24 | 4Q 24 |
|---|---|---|---|---|---|---|---|
| **Relative Research Output per kWh** | 100 | 109 | 115 | 115 | 115 | 115 | 115 |
| **Measure** | 1Q 25 | 2Q 25 | 3Q 25 | 4Q25 | | | |
| **Relative Research Output per kWh** | 115 | 115 | 115 | 115 | | | |

We define the initial measure of research output per KWh on ARCHER2 to be 100 and then estimate how this has changed with the introduction of the various environmentally considerate policies discussed under CSF04. This is estimated using applications benchmarks similar to those defined by UKRI for the procurement.

**Energy Used per CU Delivered**

| | 4Q21* | 1Q22 | 2Q22 | 3Q22 | 4Q22 | 1Q23 | 2Q23 | 3Q23 | 4Q23 | 1Q24 | 2Q24 | 3Q24 | 4Q24 | 1Q25 | 2Q25 | 3Q25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Energy per CU (kWh) | 0.719 | 0.713 | 0.728 | 0.715 | 0.650 | 0.545 | 0.669 | 0.590 | 0.568 | 0.582 | 0.585 | 0.595 | 0.546 | 0.518 | 0.578 | 0.638 |

**Energy Cost per CU Delivered**

| | 4Q21* | 1Q22 | 2Q22 | 3Q22 | 4Q22 | 1Q23 | 2Q23 | 3Q23 | 4Q23 | 1Q24 | 2Q24 | 3Q24 | 4Q24 | 1Q25 | 2Q25 | 3Q25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cost per CU (£) | £0.089 | £0.090 | £0.098 | £0.096 | £0.088 | £0.074 | £0.162 | £0.143 | £0.136 | £0.140 | £0.160 | £0.164 | £0.149 | £0.142 | £0.131 | £0.139 |

* Partial

The two tables above are calculated using the total CUs delivered by ARCHER2, the total kWh of electricity consumed, and the unit cost for kWh. The increase in “Energy Cost per CU Delivered” from 2Q23 is caused by a significant increase in the unit cost of electricity from April 2023. For 2Q23, there is also an impact on the “Energy Used per CU Delivered” from the major software upgrade that took 3 weeks. There was also an additional increase in the unit cost of electricity from April 2024.