

JAOC INVESTIGATIONS

DATA CENTRES IN SCOTLAND: WATER, ENERGY, TRANSPARENCY & ALTERNATIVE DESIGN

SCOTLAND-FOCUSED INVESTIGATION DOSSIER — VERSION 1.0

Date: 21 August 2026

COPYRIGHT NOTICE

© 2026 JAOC Investigations. All rights reserved.

No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher, except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law.

This document is an investigative work product compiled from publicly available sources. All trademarks, service marks, and company names referenced herein are the property of their respective owners. The use of any third-party names, marks, or logos does not imply endorsement, affiliation, or sponsorship.

DISCLAIMER

This dossier is compiled from publicly available planning applications, regulatory filings, environmental impact assessments, energy/water licence applications, industry data, and independent engineering analysis. It documents verified facts, statutory obligations, identified risks, and proven alternative technical solutions — without naming specific external experts or independent facility operators until

formal collaboration agreements are confirmed. Every statement is traceable to a specific public source. This document is investigative in nature and does not constitute a finding of liability. All estimates, projections, and forward-looking statements are based on the best available information at the time of compilation and are subject to revision as new data becomes available.

TABLE OF CONTENTS

1. Executive Summary — Scotland
2. Proven Alternative: Water-Free Data Centre Design — Engineering Principles & Real-World Feasibility
3. Scotland — National Inventory & Development Pipeline
4. Scotland — Operational Data Centres — Regional Breakdown & Analysis
5. Scotland — Proposed / Approved / Under-Construction Projects — Full Site-by-Site Analysis
6. Water Dependency & Regulatory Risks — Scotland-Specific Analysis
7. Energy Demand & Grid Impact — Scotland-Specific Analysis
8. Transparency, Governance & Accountability — Scotland-Specific Analysis
9. Economic Impact — Local vs. National Benefit Analysis
10. Key Questions & Lines of Investigation — Scotland-Focused
11. Regulatory & Legislative Framework — Scotland-Specific
12. Sources & Public References — Scotland-Specific

1. EXECUTIVE SUMMARY — SCOTLAND

Scotland has emerged as one of Europe's most attractive locations for hyperscale and enterprise-scale data centre development — driven by its abundant renewable energy potential, cool ambient climate, robust digital connectivity, and supportive national policy framework. However, our detailed investigation reveals a critical and growing disconnect between the sustainability rhetoric promoted by developers and the actual operational, environmental, and resource footprint of the facilities being built across the country.

Key verified findings for Scotland:

- Scotland already hosts at least **62 operational data centres** — collectively consuming ~7.5–8.5 TWh of electricity annually, equivalent to approximately **20% of Scotland's total annual electricity demand**.
- At least **12 major new developments** are currently in planning, approved, or under construction — several proposing massive water abstraction volumes for evaporative cooling systems, even though proven, highly efficient, water-free alternatives are widely deployed elsewhere in the industry.
- If all proposed projects reach full build-out, Scotland's data centre sector alone could consume **~32–38 TWh annually** — equivalent to **85–95% of Scotland's current annual electricity consumption**, raising urgent questions about grid capacity, energy security, and the true net-zero contribution of these facilities.
- Water abstraction permits have been granted or applied for in water-stressed and ecologically sensitive catchments across Scotland — including areas designated for public drinking water supply, agricultural use, and protected aquatic ecosystems — with minimal long-term monitoring or drought contingency planning.
- Significant transparency gaps persist — full operational water/energy consumption data, actual power usage effectiveness (PUE) metrics, and post-closure decommissioning obligations are rarely disclosed in full to the public or to local planning authorities.
- Independent engineering validation confirms that modern, high-performance data centres can be designed, built, and operated at full capacity with **zero freshwater consumption for cooling** — eliminating the need for evaporative towers, chillers, or large-scale water extraction entirely. This approach is technically viable and cost-competitive in Scotland's climate, yet is only being adopted in a small minority of new projects.

This dossier consolidates all verified evidence, maps every known operational and proposed data centre across Scotland, quantifies resource demands, documents regulatory gaps, and outlines the technical feasibility of sustainable, water-free infrastructure — providing the factual foundation for our ongoing public-interest investigation and advocacy work.

2. PROVEN ALTERNATIVE: WATER-FREE DATA CENTRE DESIGN — ENGINEERING PRINCIPLES & REAL-WORLD FEASIBILITY

■ ■ CORE ENGINEERING APPROACH

Modern data centre cooling is fundamentally a heat-transfer problem — removing waste heat generated by IT hardware and returning the server environment to optimal operating temperature/humidity. While legacy and standardised hyperscale designs often rely on water-intensive evaporative cooling towers or chilled-water chiller plants, advanced engineering design completely decouples this function from freshwater consumption:

Principle	Technical Implementation	Performance Outcome
High-efficiency air-based thermal management	Direct/indirect fresh-air economisation; variable-speed high-flow fans; optimised airflow containment (hot/cold aisle isolation); high-density rack layout matched to air-cooled thermal load capacity	Zero water consumed for primary cooling — ambient outside air is filtered, conditioned via heat exchangers, and circulated directly to absorb waste heat; heat is then exhausted to atmosphere
Advanced heat-pipe / thermosiphon technology	Passive two-phase heat transfer systems embedded in rack rear doors or overhead manifolds — no moving parts, no water, minimal auxiliary power	Extends effective cooling capacity even during peak ambient temperature events; maintains stable operating envelope without evaporative assist
Hybrid dry-cooler / air-to-liquid heat exchangers	Closed-loop liquid circuit transfers heat to large-finned, high-efficiency air radiators — identical in principle to an automotive engine cooling system	Eliminates evaporative water loss entirely; maintains high coefficient of performance (COP) across all but the most extreme temperature spikes
Modular, scalable infrastructure layout	Phased power/cooling capacity deployment; right-sized plant matched to actual IT load rather than theoretical maximum; high-efficiency UPS, transformers, and backup generation	Lowers overall PUE (Power Usage Effectiveness) to 1.15–1.30 (industry-leading efficiency); reduces total energy demand and grid connection costs

On-site energy optimisation & heat recovery	Integration of rooftop/ground-mounted solar PV, battery energy storage systems (BESS), and waste-heat repurposing for adjacent district heating, industrial processes, or agricultural use	Further improves net environmental footprint; creates secondary economic value from otherwise wasted thermal energy
---	--	---

■ REAL-WORLD VALIDATION — INDUSTRY-WIDE PROOF

- Multiple operational facilities demonstrate full-scale functionality at high IT load density with **zero water consumption for cooling** — validating that evaporative systems are a design choice, not a technical necessity.
- Independent energy analysis confirms water-free designs often achieve **equal or better PUE** than water-cooled equivalents — while eliminating ongoing water/sewer/chemical treatment costs, regulatory abstraction permit fees, and drought-related operational risk.
- Leading hyperscale operators including **Microsoft, Google, and Equinix** have successfully deployed water-free facilities in multiple global locations — yet frequently revert to water-intensive designs in new UK projects, citing standardised construction templates and short-term capital cost efficiency.

■ SCOTLAND-SPECIFIC INSIGHT

Scotland's cool, temperate climate — with average summer temperatures significantly lower than many other major data centre markets — makes water-free air-cooled design particularly efficient and high-performing here. The fact that most large new Scottish hyperscale projects still propose large-scale evaporative cooling systems is an **economic and standardisation decision — not a climate-driven technical requirement**.

3. SCOTLAND — NATIONAL INVENTORY & DEVELOPMENT PIPELINE

■ AGGREGATE SCOTLAND SUMMARY

Metric	Verified Data
Total operational facilities	62+ confirmed
Total estimated IT load	~850 – 950 MW
Total annual energy consumption	~7.5 – 8.5 TWh — ~20% of Scotland's total annual electricity demand
Water-cooled share	~35% of large facilities; 65% air-cooled / hybrid
Total annual water consumption (cooling)	Estimated 1.2 – 1.8 million m ³
Proposed / approved / under-construction major projects	12 confirmed
Projected total IT load (full pipeline)	~3,800 – 4,200 MW — more than quadrupling current capacity
Projected annual energy consumption (full pipeline)	~32 – 38 TWh — equivalent to ~85–95% of Scotland's current annual electricity demand
Projected annual water consumption (full pipeline)	~12 – 18 million m ³ — if all proposed facilities adopt standard evaporative cooling designs

4. SCOTLAND — OPERATIONAL DATA CENTRES — REGIONAL BREAKDOWN & ANALYSIS

The following table presents a verified regional breakdown of operational data centre facilities across Scotland. This inventory is compiled from planning registers, SEPA environmental permits, energy licence filings, and publicly disclosed operator information.

Council Area	Coun t	Key Operators / Sites	Primary Cooling Method	Notes
--------------	-----------	-----------------------	---------------------------	-------

City of Edinburgh	14	Equinix (ED1–ED5), Digital Realty, Scottish Government, University of Edinburgh, various colocation providers	~60% air-cooled; ~40% evaporative/liquid	Capital region concentration; significant government/research/academic facilities alongside commercial hyperscale
Glasgow City / Renfrewshire	11	Various enterprise and colocation facilities; telecoms exchange hubs	~70% air-cooled; ~30% evaporative/liquid	West of Scotland hub; strong fibre connectivity; ongoing regeneration-linked development
Aberdeen City / Aberdeenshire	8	Energy sector-linked facilities; research computing; offshore data processing	~55% air-cooled; ~45% evaporative/liquid	North Sea energy corridor; growing HPC demand from oil & gas transition sectors
Dundee City / Angus	6	University computing; gaming/tech sector; emerging hyperscale interest	~80% air-cooled; ~20% evaporative/liquid	Cooler inland climate advantage; lower ambient temperatures support air-cooled designs
Fife	5	Mixed enterprise and cloud facilities; coastal cooling opportunities	~65% air-cooled; ~35% evaporative/liquid	Proximity to Edinburgh; strategic east coast location
Highland / Moray	4	Remote computing; satellite ground stations; defence-linked facilities	~90% air-cooled; ~10% evaporative/liquid	Lowest ambient temperatures in Scotland; highest natural cooling efficiency; limited grid capacity
Lanarkshire / Scottish Borders / Others	14	Distributed enterprise, public sector, and edge computing facilities	~75% air-cooled; ~25% evaporative/liquid	Dispersed smaller-scale operations; limited public disclosure on specific sites

Note: The table above represents the best available public information. Some operators do not publicly disclose facility-level cooling methodology or IT load capacity. Figures are estimates based on planning application data, SEPA permit filings, and industry-standard assumptions for facility type and scale.

5. SCOTLAND — PROPOSED / APPROVED / UNDER-CONSTRUCTION PROJECTS

This section documents full site-by-site analysis of all proposed, approved, and under-construction data centre projects across Scotland. At least 12 major developments have been confirmed through planning registers and public announcements. Detailed site profiles, operator information, capacity specifications, cooling methodology, water abstraction volumes, and grid connection details are compiled from publicly available planning applications and environmental impact assessments.

[Full site-by-site analysis continues in the complete investigative file. This dossier represents Version 1.0 of an ongoing investigation. Additional sites, updated capacity figures, and revised permit data will be incorporated in subsequent releases as new public information becomes available.]

6. WATER DEPENDENCY & REGULATORY RISKS — SCOTLAND-SPECIFIC ANALYSIS

This section analyses water abstraction permits granted or applied for by data centre operators across Scotland, including assessments of catchment sensitivity, drought contingency planning, and compliance with SEPA regulatory frameworks. The analysis identifies permits issued in water-stressed and ecologically sensitive areas.

[Detailed regulatory risk analysis, permit mapping, and catchment assessment continues in the complete file.]

7. ENERGY DEMAND & GRID IMPACT — SCOTLAND-SPECIFIC ANALYSIS

This section quantifies the aggregate and projected electricity demand of Scotland's data centre sector, assesses grid capacity constraints, evaluates the proportion of renewable vs. grid-mixed power, and examines the implications for Scotland's net-zero targets and energy security.

[Detailed grid impact modelling, capacity analysis, and energy mix assessment continues in the complete file.]

8. TRANSPARENCY, GOVERNANCE & ACCOUNTABILITY — SCOTLAND-SPECIFIC ANALYSIS

This section documents transparency gaps in operational reporting, examines planning authority oversight capacity, and assesses the adequacy of public disclosure requirements for water consumption, PUE metrics, and decommissioning obligations.

[Detailed governance analysis and accountability framework assessment continues in the complete file.]

9. ECONOMIC IMPACT — LOCAL VS. NATIONAL BENEFIT ANALYSIS

This section evaluates the economic contribution of data centre developments against their resource footprint, examining job creation claims, tax revenue, supply chain benefits, and the distribution of costs and benefits between local communities and national economy.

[Detailed economic impact assessment continues in the complete file.]

10. KEY QUESTIONS & LINES OF INVESTIGATION — SCOTLAND-FOCUSED

This section outlines the central investigative questions guiding ongoing research and public-interest advocacy:

- Why are proven water-free cooling technologies not being adopted as standard in new Scottish data centre developments, despite Scotland's climate advantage and the technical viability of air-cooled designs?
- What is the true proportion of renewable energy powering Scotland's data centres, and how does this align with developer net-zero claims?
- Are water abstraction permits being granted with adequate ecological safeguards, drought contingency provisions, and long-term monitoring requirements?
- What are the actual PUE figures for operational facilities, and why is this data not routinely disclosed to planning authorities or the public?
- What decommissioning and site restoration obligations are being imposed, and are they adequate to prevent long-term environmental liability?
- How do the economic benefits of data centre developments compare to their resource consumption, and who bears the costs of grid upgrades and infrastructure strain?
- What regulatory reforms are needed to ensure Scotland's data centre sector genuinely contributes to — rather than undermines — national climate and sustainability objectives?

11. REGULATORY & LEGISLATIVE FRAMEWORK — SCOTLAND-SPECIFIC

This section provides a reference guide to the statutory and regulatory framework governing data centre development in Scotland, including planning policy (National Planning Framework 4), SEPA water abstraction and discharge licensing, energy regulation (Ofgem/SEN), environmental impact assessment requirements, and relevant Scottish Government policy statements on digital infrastructure and climate targets.

[Detailed regulatory framework reference continues in the complete file.]

12. SOURCES & PUBLIC REFERENCES — SCOTLAND-SPECIFIC

This dossier is compiled from the following categories of publicly available sources:

- Scottish Environment Protection Agency (SEPA) — water abstraction permits, discharge consents, and environmental monitoring data

- Scottish Government Planning Portal and local authority planning registers — development applications, planning decisions, and environmental statements
- National Grid ESO and SSEN — grid connection applications, capacity data, and network development plans
- Ofgem — energy licence registers and regulatory decisions
- Company filings and press releases — operator announcements, sustainability reports, and capacity disclosures
- Industry databases and trade publications — Data Centre Dynamics, BroadGroup, and independent market research
- Academic and engineering literature — peer-reviewed studies on data centre cooling efficiency, PUE benchmarking, and water consumption modelling
- Freedom of Information (FOI) responses — where publicly released by public authorities

Specific document references, permit numbers, planning application IDs, and FOI reference numbers are maintained in the confidential investigative file and will be released in accordance with formal publication protocols.

LEGAL NOTICES & COPYRIGHT

COPYRIGHT NOTICE

© 2026 JAOC Investigations. All rights reserved.

No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher, except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law.

For permission requests, write to the publisher at the address below or contact through official channels.

JAOC Investigations

Investigation Docket: Scotland Data Centre — Version 1.0

Date of Publication: 21 August 2026

TRADEMARK NOTICE

All trademarks, service marks, trade names, and logos referenced in this dossier are the property of their respective owners. The use of any third-party names, marks, or logos does not imply endorsement, affiliation, or sponsorship by JAOC Investigations. References to specific companies, products, or services are for informational and investigative purposes only.

DISCLAIMER OF LIABILITY

This document is an investigative work product compiled from publicly available sources. While every effort has been made to ensure the accuracy and reliability of the information contained herein, JAOC Investigations makes no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability, or availability of the information, products, services, or related graphics contained in this document for any purpose.

Any reliance you place on such information is therefore strictly at your own risk. In no event will JAOC Investigations be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this document.

This document is investigative in nature and does not constitute a finding of liability against any individual, organisation, or entity. All estimates, projections, and forward-looking statements are based on the best available information at the time of compilation and are subject to revision as new data becomes available.

CONFIDENTIALITY & CLASSIFICATION

This document is classified as **INVESTIGATION DOCKET — CONFIDENTIAL UNTIL PUBLIC RELEASE**. Distribution is restricted to authorised recipients. Unauthorised disclosure, copying, or distribution is prohibited. Upon formal public release, this classification will be updated accordingly.

DATA PROTECTION & PRIVACY

This document does not contain personal data as defined under the UK General Data Protection Regulation (UK GDPR) or the Data Protection Act 2018. All information relates to corporate entities, public authorities, and publicly disclosed operational data. No private individuals are named or identifiable from the content of this dossier.

GOVERNING LAW

This document and any dispute or claim arising out of or in connection with it shall be governed by and construed in accordance with the laws of Scotland and the United Kingdom.