How GWDG Leverages CoolIT's DLC to Meet High-Performance Computing Demands

By adopting direct liquid cooling, GWDG supports higher-density computing, improved energy efficiency and the performance required for leading-edge HPC research.

Introduction

Before the AI boom, high-performance computing (HPC) had already exposed the limits of air cooling. Dense workloads routinely exceeded 100 kW per rack requiring liquid cooling. As AI pushes even greater densities, the industry is quickly learning that many of the answers lie in HPC's pioneering developments.

Since 2013, CoolIT Systems has worked alongside global HPC leaders, delivering liquid cooling technology for some of the most demanding compute environments in the world. This experience has proven critical in meeting the needs of public institutions like GWDG, which must balance system performance with strict environmental and regulatory standards.

The Customer

The Gesellschaft für wissenschaftliche Datenverarbeitung mbH Göttingen (GWDG) is a joint institution of the Georg August University of Göttingen and the Max Planck Society. As the IT competence center for the Max Planck Society and the computing and data center for the University of Göttingen, GWDG plays a critical role in advancing computational research in Germany. The GWDG is part of the National High Performance Computing Alliance of Germany (NHR) and is one of its nine operating sites.

The focus of the NHR site at the University of Göttingen and GWDG is to expand its competencies in the areas of life sciences, earth system sciences, fluid mechanics, artificial intelligence (AI), big data and digital humanities. The data center is a critical part, enabling researchers at both the University and the Max Planck Society – renowned for its cutting-edge research - to run parallel data and compute intensive applications.

Customer Challenge: Air Cooling Limits Performance and Cost Efficiency

GWDG's Emmy supercomputer, with compute densities ranging from 45 kW to 96 kW per rack, pushed their existing air cooling systems to the limit. Air cooling was no longer sufficient, not only due to thermal inefficiencies but also operational costs.

Energy efficiency is a driving factor. Air cooling of a data center accounts for upwards 40% of total operating costs. Operating just the fans alone of an air-cooled systems can consume 8–15% of server power just to maintain safe thermal margins. In Germany, electricity costs are about four times higher than in the US, with an average price of over $0.43 per kilowatt hour (kWh) compared to $0.15/kWh in North America. This stark difference meant that inefficiencies in cooling could quickly escalate operating costs. Even a 10–20% improvement in cooling efficiency yields €100,000+ in annual savings for facilities operating at megawatt scale.

Estimated Cooling Power Cost Comparison: (1MW IT Load, €0.43/kWh)

Cooling Method	**Cooling Power Draw (% of IT Load)**	**Cooling Power (kW)**	**Annual Energy Use (kWh)**	**Annual Cost (€)**
Air Cooling	12%	120 kW	1,051,200	€452,016
Direct Liquid Cooling (DLC)	3%	30 kW	262,800	€113,004

Above results in a 75% decrease in cooling power draw, alongside a 75% reduction in annual energy use, delivering €339,012 in annual savings and reducing cooling costs from €452,016 to €113,004. At megawatt scale, this delta clearly demonstrates that cooling efficiency directly drives operating economics.

As public entities, all nine NHR sites in Germany are required to consider sustainability. This is both a government mandate and a customer requirement. Regulations like Germany's Green IT initiatives, Energy Efficiency Directive and German Energy Efficiency Act released in 2024, plus heat reuse mandates, required GWDG to find innovative ways to reduce energy and water usage. This further underscored the need for closed-loop liquid cooling systems.

GWDG is also pursuing ISO and the German "Blauer Engel" certification, both of which are easier to achieve with DLC. For customers and partners that prioritize sustainability, these certifications validate GWDG's approach and demonstrate a clear commitment to responsible infrastructure design.

Why GWDG Chose CoolIT

With a need for stability, GWDG needed to make a business case to invest in high-efficiency cooling technology with a company that both offered long-term support (at least 10 years) and has a proven track record.

Liquid cooling technology: With many liquid cooling methods available, the challenge was to find a product that fit seamlessly into their existing system without requiring a complete infrastructure overhaul. GWDG rejected immersion and two-phased DLC due to complexity and operational limitations, while it regarded CoolIT's single phase DLC liquid cooling technology as more mature. In addition, the technology could be easily fit within GWDG's existing data center infrastructure, saving time, cost and, most critically, avoiding significant operational downtime.

Compute vendor independence: Multi-vendor support and its interoperability was also a critical consideration. GWDG operated several different compute systems across multiple data centers. To avoid hosting different vendor-specific solutions, they required a flexible system that can be easily integrated to existing clusters. The systems, supplied by various vendors including Intel, Gigabyte, Inspur, Supermicro and Dell. This comprised around 3,500 compute nodes, with about 3,000 or 86% using DLC. GWDG chose CoolIT due to the technical maturity of single-phase DLC and broad technology ecosystem with multi-vendor support. This flexibility prevented the University from being locked-in to one server vendor while providing a DLC system that can adapt to a wide range of operating conditions. CoolIT's on-site technical support was also an important deciding factor.

CoolIT Systems' Solution for GWDG's Emmy Supercomputer

CoolIT's relationship with GWDG began in 2020 with the installation of the Emmy cluster in Göttingen, Germany. Emmy is a CPU-based system with approximately 1,500 compute nodes. 1,100 of which use CoolIT's direct liquid cooling (DLC) technology.

The Emmy system consists of 12 racks of liquid-cooled servers. These are supported by 12 stainless steel CoolIT rack manifolds equipped with all-metal, dry-break quick disconnects, which enable hot-swappable servicing of individual nodes without downtime. Liquid is circulated through a technology cooling system pipping beneath the racks and cooled via three CHx750 Coolant Distribution Units (CDU).

Designed for warm-water operation, the system accepts coolant inlet temperatures up to 32 °C. This minimizes chiller dependency, supporting year-round energy-efficient operation. The installation also integrates with Stulz CRS in-row air handlers to manage residual heat loads, creating a nearly room-neutral thermal profile. The recovered waste heat is routed to adjacent university buildings and a campus greenhouse, supporting GWDG's broader sustainability strategy and Germany's emerging data center heat reuse mandates.

The system has been delivered together with Atos/Bull and Intel.

The Emmy Supercomputer Liquid Cooling Technology HPC setup includes:

12x racks with direct liquid cooled Intel Computing servers

12x CoolIT Stainless steel Rack Manifolds, featuring 100% dry-break quick disconnect technology

3x CoolIT row-based CDUs managing 12 racks

Custom technology cooling system pipping below the racks

Nearly room neutral solution with Stulz CRS Cyberrows and Insulated Racks

Customer Benefits

By reducing dependency on fans and air handling equipment, **extremely high rack densities** are made possible, while the power consumed by the cooling system drops significantly.

This results in **more power availability for computing**, as each server in each rack can be liquid cooled, as well as a significantly reduced carbon footprint and **improved PUE**. In fact, direct liquid cooled system implementations easily outperform the most efficient air-cooled systems delivering a PUE of 1.07 for the DLC-cooled nodes in GWDG's Emmy cluster.

"Our consistently low chip temperatures allow us to operate at the highest clock frequencies," the GWDG team adds.

This **peak performance** will assist the team at GWDG in the research of AI methods and their high-availability and data protection-oriented provision in an AI service center for critical and sensitive infrastructures (KISSKI).

GWDG has also **extended the lifecycle of their existing data center infrastructure** by modernizing with direct liquid cooling while avoiding the need for costly new construction. The result is strong investment protection through facility reuse and long-term scalability.

Heat reuse has been another standout benefit. Waste heat from GWDG's DLC systems is used to heat office spaces and nearby university facilities, a capability that aligns with upcoming German sustainability laws. And this is possible because DLC systems can operate with higher temperature cooling loops, making the captured heat more suitable for heating applications.

> **“CoolIT's DLC technology allows us to meet our customers' growing computing needs in a sustainable and cost-effective manner, without compromising our ability to adapt to changing technologies. Their support is also very helpful in our mission to always provide the best technology for our customers' challenges.”**
>
> **Christian Boehme,**
> **Deputy head of the**
> **Computing group at GWDG**

Conclusion

GWDG successfully deployed CoolIT’s single-phase direct liquid cooling technology across its Emmy supercomputer to support growing AI and HPC workloads with greater efficiency flexibility and scalability. By integrating DLC into its existing infrastructure, GWDG improved compute performance reduced cooling-related energy consumption and advanced its sustainability objectives.

- Increasing compute density while achieving a PUE of 1.07 for DLC-cooled nodes in the Emmy cluster
- Reducing cooling power consumption from 12% to 3% of IT load to lower operational energy costs
- Enabling modular multi-vendor interoperability across Intel Gigabyte Inspur Supermicro and Dell compute environments
- Supporting warm-water cooling and heat reuse initiatives to improve sustainability and reduce carbon impact
- Simplifying maintenance and minimizing downtime with dry-break quick disconnect technology for hot-swappable servicing

GWDG also highlighted CoolIT’s mature technology long-term support and operational expertise as key factors in delivering a reliable future-ready cooling platform for next-generation AI and scientific computing workloads.

About CoolIT Systems

CoolIT Systems is a global leader in liquid-cooling solutions for AI and high-performance computing. CoolIT designs, manufactures and services liquid-cooling hardware for global server, cloud service provider (CSP) and data center markets. The company’s single-phase direct liquid-cooling (DLC) technology is used in high-density, high-efficiency computing environments, and advanced AI infrastructure. CoolIT’s DLC systems are used in seven of the top 10 supercomputers and many hyperscale CSP sites. In 2026, Data Center Magazine named CoolIT as #1 direct to chip cooling company and in the top three cooling companies worldwide.

For more information about CoolIT Systems, its products and technology, visit www.coolitsystems.com