Academic Research | Germany

Gaining insights and advancing climate policies for a better world

Potsdam Institute for Climate Impact Research (PIK)

PIK multiplies its supercomputer performance by deploying Lenovo ThinkSystem servers powered by AMD EPYC™ processors and Lenovo Neptune® Liquid Cooling technology, providing researchers with new HPC capabilities while boosting energy efficiency.

1 Customer background

Who is PIK?

Based in Germany, Potsdam Institute for Climate Impact Research (PIK) is a leading organization focused on bringing together different disciplines from natural sciences and social sciences to better understand global challenges. With around 500 staff and annual funds of €33 million, PIK aims to develop actionable solutions for the world's pressing climate problems and advance the frontiers of integrated research for global sustainability.

PIK is one of the world's key players in developing integrated models covering the atmosphere, hydrosphere, biosphere, and the Anthropocene to answer key questions and deliver crucial insights and scientific advice for policy decision-making.

2 The challenge

Most research at PIK relies on complex computations, so when the institute was founded in 1992, it immediately invested in a powerful high-performance computing (HPC) system. The demand for HPC capacities has only grown since then.

The interdisciplinary research that makes PIK unique often requires running medium-sized analyses and numerical simulations iteratively, many times over with dynamically changing parameters. Based on the results, researchers at PIK can then better understand complex relationships and interdependencies, helping them to derive new insights and develop sustainable climate policy guidance and actionable recommendations for world leaders. To enable this interactive scenario-based approach and stay at the forefront of global research, PIK's scientists needs quick and easy access to in-house HPC clusters that are large enough to enable fast feedback loops.

2 The challenge

PIK supports fundamental research and collaborates with the global scientific community, partnering with other leading organizations such as the Max Planck Institute for Meteorology. To continue its successful cooperations and advance academic research, PIK was looking to massively expand its HPC capacities while ensuring high energy efficiency.

The institute runs advanced, fully coupled, medium-complexity models taking into account oceans, ice shields, and the atmosphere. Key components of the model landscape at PIK are the Potsdam Earth Model (POEM) and a comprehensive Earth System Model of Intermediate Complexity (EMIC) called CLIMBER-X—both requiring substantial HPC resources at scale.

In parallel, big data analytics has become more essential for many fields of research at PIK, including the cutting-edge research initiative FutureLab “Artificial Intelligence in the Anthropocene.” This meant that PIK was looking to beef up its AI and machine learning (ML) capabilities by adding more GPUs to its clusters, supporting new innovative studies and approaches.

“We really need fast and reliable HPC systems in-house. Relying exclusively on external HPC resources would slow down our research and increase overheads for our scientists. We want our academic staff to **focus on generating new knowledge to provide policy recommendations**. As we are all about climate research, our own carbon footprint is important to us too, so we wanted a **highly efficient, direct water cooling solution** that will enable us to heat our office buildings on the Albert-Einstein Campus exclusively by utilizing waste heat.”

Karsten Kramer

Head of IT Services & HPC, Potsdam Institute for Climate Impact Research

3 The solution

Delivering leading efficiency and performance

Following an EU-wide bidding and selection process, PIK engaged in a competitive dialogue procedure with two vendors.

After discussing over 1,000 criteria, PIK decided to work with Lenovo and pro-com DATENSYSTEME GmbH to deploy a new highly cost-efficient solution powered by 64-core AMD EPYC™ 9554 processors.

Hardware

Lenovo ThinkSystem SD665 V3 Neptune® DWC Server
Lenovo ThinkSystem SD665-N V3 Neptune® DWC Server with high-performance GPUs
Lenovo Neptune® Liquid Cooling
AMD EPYC™ 9554 processors
Lenovo ThinkSystem SR665
Lenovo ThinkSystem SR645
Lenovo ThinkAgile HX Series
Lenovo ThinkSystem DE4000H Hybrid Storage Array Gen2
Lenovo ThinkSystem DM5000H Unified Hybrid Storage Array

3 The solution

Using generous grants from Federal State of Brandenburg, PIK installed 240 Lenovo ThinkSystem SD665 V3 Neptune® direct water cooling (DWC) compute servers, 12 Lenovo SD665-N V3 Neptune® DWC servers with additional GPU accelerators, as well as Lenovo ThinkSystem SR665 and SR645 servers for management and support tasks in combination with a Lenovo ThinkSystem DE4000H Hybrid Storage Array Gen 2 for data backups.

Software

Lenovo's HPC and AI software stack
Nutanix Cloud Platform
Confluent Cluster Management
Slurm Workload Manager
Red Hat Enterprise Linux for HPC with Lenovo Support

Services

Lenovo Professional Services
pro-com DATENSYSTEME GmbH

3 The solution

Lowering barriers for HPC and AI users

The new HPC solution was implemented by Lenovo Professional Services and pro-com DATENSYSTEME GmbH using Red Hat Enterprise Linux, Confluent Cluster Management software, and Slurm Workload Manager. PIK is working with Lenovo to complete the setup of the open Lenovo HPC and AI software stack designed to support a unified environment for diverse workloads.

“With more researchers from social sciences and other less technical fields making use of data science, AI, and ML tools on our HPC cluster, easy usability is becoming more important,” says Karsten Kramer, Head of IT Services & HPC at PIK. “We see huge potential in Lenovo’s unified HPC and AI software stack, as it will simplify access to our HPC resources for interdisciplinary teams by providing standard web interfaces and containerized tools that our users are already familiar with.”

3 The solution

Beyond HPC, PIK is working with pro-com DATENSYSTEME GmbH to modernize its general-purpose server landscape.

To support business users and run a wide range of business and support systems, PIK uses highly efficient hyperconverged infrastructure (HCI) solutions based on Lenovo ThinkAgile HX Series and Nutanix Cloud Platform in combination with a high-availability Lenovo DM5000H scale-out storage cluster.

“Lenovo delivered a top-quality solution powered by very fast and cost-efficient AMD EPYC™ processors.”

Karsten Kramer

Head of IT Services & HPC, Potsdam Institute for Climate Impact Research

“Together with Lenovo and our experienced HPC partner pro-com DATENSYSTEME GmbH, we deployed a new HPC environment that **provides outstanding performance and supports efficient, sustainable operations** with advanced direct water cooling that even heats our office workplaces across several buildings. Thanks to Lenovo’s reliable supply chain, we completed the implementation faster and **accelerated research at our institute to new levels**.”

Karsten Kramer

Head of IT Services & HPC, Potsdam Institute for Climate Impact Research

4 The results

Efficiency and sustainability were particularly important for PIK. By selecting leading Lenovo Neptune® Liquid Cooling solutions, PIK benefits from a future-proof, flexible system architecture with an external coolant distribution unit that can easily be connected to several racks and hooked up to heating systems and networks. The coolant distribution unit was specially adapted for PIK.

In addition to the usual redundancies regarding power supply, filters, and management, this customized solution features two fully redundant heat exchangers. This allows PIK to expand its fully redundant data center design to direct water cooling. Furthermore, the solution also supports a maximum temperature for heat extraction. Together, these customizations ensure that all PIK's unique requirements were optimally met.

4 The results

Direct water cooling also has positive effects on system performance. With more consistent temperatures, HPC workloads run more stable and jobs complete faster. There is no unexpected throttling of core speeds and less variability between processes, avoiding wait times and wasted compute cycles.

- 5x more computational capacity measured using real-world scientific applications
- 2.5x better energy efficiency even before accounting for waste heat reuse
- 5-10x performance improvement depending on workload

4 The results

Supporting policymaking with scientific insights

Thanks to the new HPC cluster, scientists at PIK can now process larger amounts of data faster and run more complex simulations.

PIK has been surprised about how fast demand for its new GPU resources has been growing. About 50% of the GPU workloads are large language models (LLMs). “Our researchers are finding more and more use cases for our GPU capacities,” explains Kramer. “One current example is an automated machine learning analysis of almost 85,000 climate policy papers, such as the comprehensive assessment reports by the Intergovernmental Panel on Climate Change [IPCC]. A team at PIK used the Lenovo cluster to identify the relevant papers from a total list of one million publications. Then they trained machine learning classifiers, automatically categorized climate policy details, and compiled an interactive climate policy map based on the findings. The results of the analysis were published in an open-access publication by Springer Nature—all enabled by our new Lenovo supercomputer, financed by the Future Investment Fund of the State of Brandenburg.”

“A huge benefit of our new HPC cluster is the **Lenovo Neptune direct warm water cooling design**. We’re **heating 250 workplaces with excess heat from our supercomputer** today and don’t have any other heating system in the entire building. Right now, we’re adding a local heating network to connect more buildings on our campus and we’re exploring the possibility of using outside air for free cooling, further increasing efficiency.”

Karsten Kramer

Head of IT Services & HPC, Potsdam Institute for Climate Impact Research

Why Lenovo and AMD?

Already having experience with Lenovo solutions, the excellent quality and reliability of the systems and services were key criteria for PIK in choosing Lenovo again. “One of the most important reasons for selecting Lenovo was the superior benchmarking results using scientific applications which PIK achieved thanks to Lenovo’s outstanding expertise in this area. Overall, the Lenovo solution offered the best cost-efficiency and performance.

“We simply know that we can rely on Lenovo infrastructure, day in and day out,” confirms Kramer. “We were even told during a scheduled maintenance by a third-party vendor that there are some tasks they only do remotely on Lenovo systems, because on Lenovo infrastructure they are so confident they can finish the job without issues. Lenovo and AMD are a winning combination for HPC, with the AMD EPYC 9554 processors delivering exceptional performance.”

“What’s more, while working with Lenovo and partner pro-com DATENSYSTEME GmbH we have built up a strong relationship and mutual trust. There is continuity in our communications and they provide very good support whenever we have a question.”

Karsten Kramer

Head of IT Services & HPC, Potsdam Institute for Climate Impact Research

“We are working closely with PIK across their HPC systems, storage, and their hyperconverged infrastructure. It’s great to work together with one of Germany’s most high-profile scientific research institutions and **help them provide valuable advice about global climate challenges**. Besides doing installations and regular maintenance on the systems, we also prioritize clear and complete documentation to enable PIK to stay on top of their data center and **support smooth operations of their mission-critical IT services**.”

pro-com DATENSYSTEME

Oliver Kill

CEO, pro-com DATENSYSTEME GmbH

How can a leading research institute power up its HPC resources?

Working with pro-com DATENSYSTEME GmbH and Lenovo, PIK has installed a powerful new HPC cluster with highly efficient direct water cooling.

Explore Lenovo HPC Solutions