

A photograph of a data center aisle, showing rows of server racks on both sides. The racks are illuminated with a greenish-blue light, and the floor is a light-colored tile. The image is framed by a large, semi-transparent blue circle.

COOLING SOLUTIONS FOR AI: AQUATHERM BLUE

Highly efficient and sustainable cooling solutions
for data centres



🏠 Table of contents

- ➔ 3 Introduction __
- ➔ 4 AI: Essential cooling for operations __
- ➔ 4 Who knows about it? __
- ➔ 4 What is important in risk management __
- ➔ 5 What planners and operators are interested in __
- ➔ 6 Why PP-RCT is the pipe material of the future __
- ➔ 6 What makes PP-RCT plastic so special? __
- ➔ 7 Material advantages of PP-RCT compared to steel and copper __
- ➔ 7 Outstanding cost-effectiveness __
- ➔ 7 Optimal Power Usage Effectiveness (PUE) __
- ➔ 8 aquatherm blue in action __
- ➔ 9 Thinking outside the box: Utilising waste heat for district heating __
- ➔ 9 Sustainability strategies of modern data centres __
- ➔ 10 Result __

Introduction __

With the rapid development of cloud computing and artificial intelligence (AI), Data Centres worldwide are experiencing tremendous growth. These technologies are driving the digital economy, but at the same time, require a powerful and efficient infrastructure. A key aspect of this, is energy efficiency, especially in terms of cooling. Data Centres generate significant amounts of heat, which must be dissipated effectively to ensure the operational safety and functionality of the equipment.

aquatherm has developed aquatherm blue, an innovative plastic pipe system specifically designed to meet the challenges of modern Data Centres. aquatherm therefore offers a sustainable and energy-efficient solution to cope with the increasing demand for cooling. The pipe technology or the material PP-RCT makes a significant contribution to significantly reducing energy costs and at the same time increasing operational safety and environmental compatibility.



AI: Essential cooling for operations __

The manufacturers of AI chips such as Nvidia are driving innovations at ever shorter intervals. The new generation of chips with Blackwell accelerator architecture is four times more powerful than the current Grace Hopper system. Large IT companies are already planning to use Nvidia's Blackwell GPU on a large scale.

Although the new AI chips achieve more power with less energy, they drive heat genera-

tion from AI racks of 50 kW and above to new heights. Currently, the power density is in the 65 to 75 kW ranges, with the expectation that AI racks will go far beyond the 150-kilowatt capacity. For example, companies like Cyrus-One are planning 300-kilowatt racks.

Comparing these performance figures with the traditional racks from 48 to 50 kW, it becomes clear how important cooling and water cooling will play.

Who knows about it? __

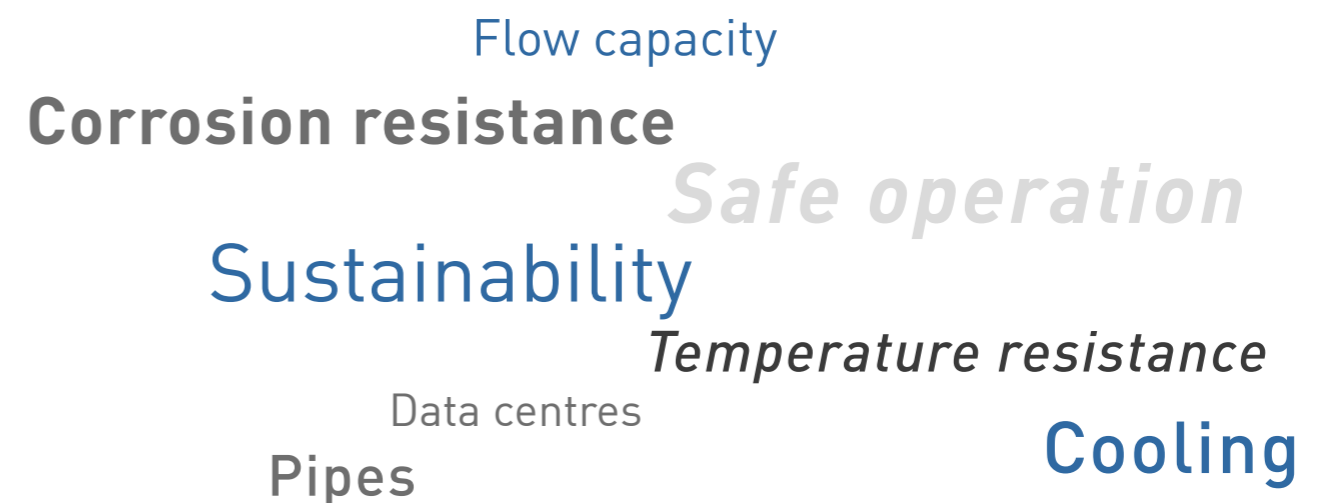
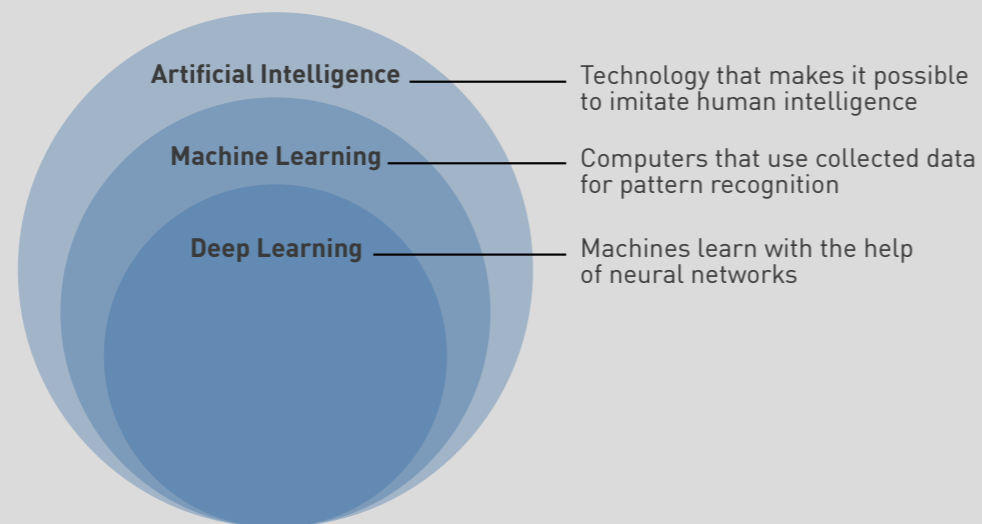
For data centre planners and operators looking to modernise, the challenge lies in the limited number of companies globally with the expertise and experience in advanced data centre cooling. aquatherm is one of these elite companies.

What is important in risk management __

A decisive factor in cooling is the piping. Although they only account for a fraction of the costs, their flow rate, temperature resistance, corrosion resistance and sustainability depend on their long-term safe operation. Modern plastic pipe systems are far superior to conventional metallic ones. For over 50

years, aquatherm has been convincing with its expertise and innovative strength in the field of plastic pipes. The company is represented in more than 70 countries around the globe and supports its customers locally – including planners and operators of data centres.

Gradations of artificial intelligence, machine learning and deep learning



What planners and operators are interested in ___

If you are planning a new data centre or want to bring an existing one up to the latest state of the art, three key factors are crucial for effective cooling:

- **The material**

What type of plastic should I choose for my pipe system?

- **Prefabrication**

Can I save time, costs and personnel during project implementation by precisely prefabricating the pipe systems?

- **The future viability**

For example, can my pipe system be converted from air to water cooling without any problems?

- **Sustainability**

Does the pipe system have EPDs, certifications and recycling certificates so that I can meet even the most demanding sustainability goals and regulations?

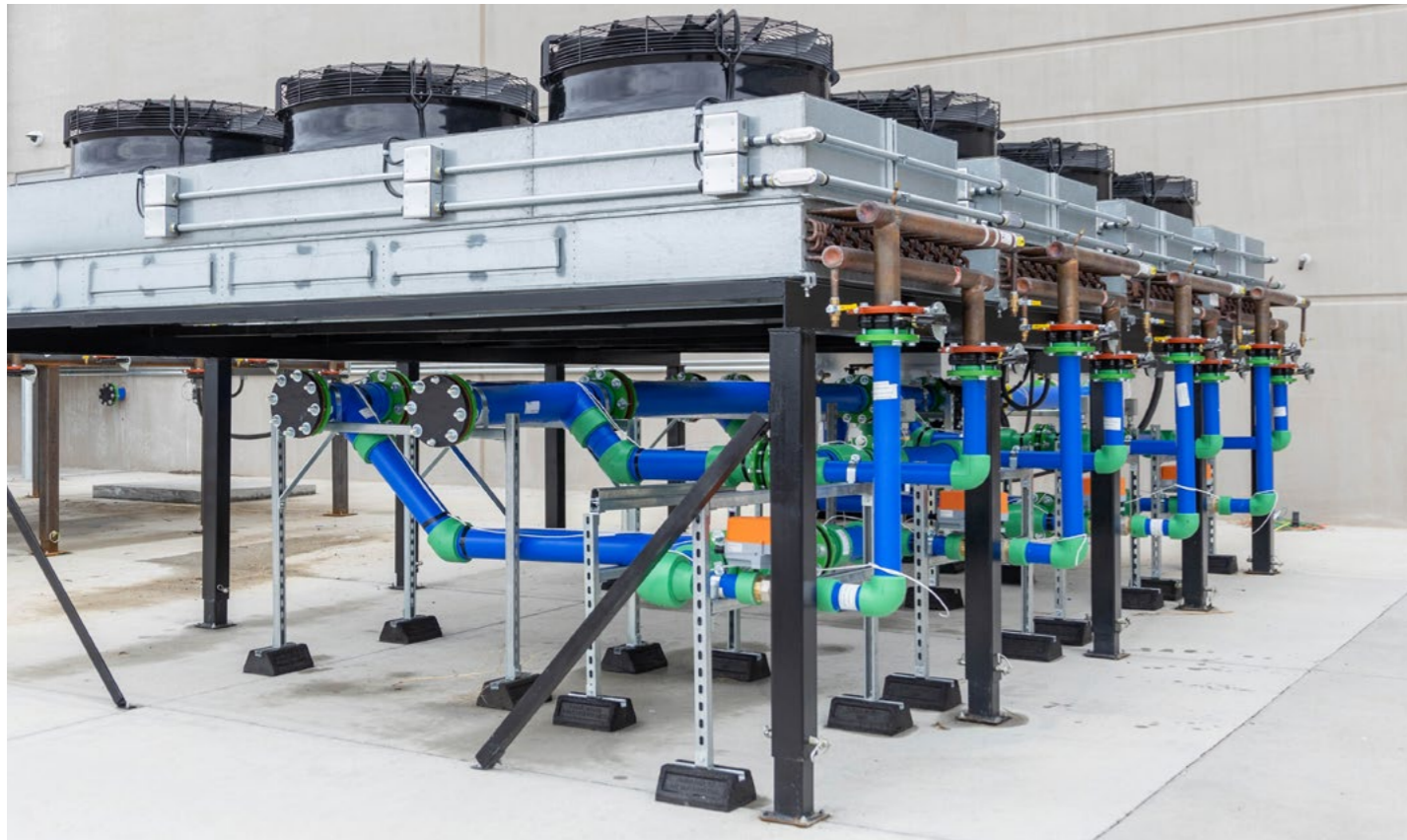
In anticipation of your enquiry:
With aquatherm you get solutions that meet all requirements.



Part of
the solution.



Why PP-RCT is the pipe material of the future ___

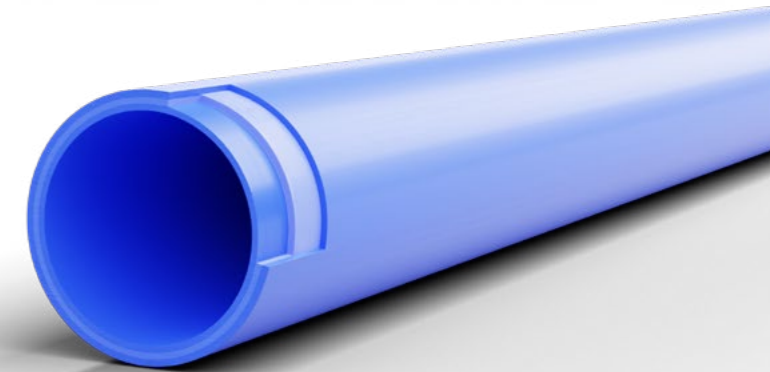


The aquatherm blue pipe system is the solution that is tailored to the current and future needs of data centres. Crafted from polypropylene random copolymer type PP-RCT

(PP-RCT), this innovative system has rapidly emerged as the top choice for direct chip cooling applications within data centres.

What makes PP-RCT plastic so special? ___

- PP-RCT is a newer generation PP-R material with higher long-term strength at elevated temperatures.
- PP-RCT pipes are lighter yet more resistant than PP-R pipes.
- aquatherm piping systems can withstand extreme conditions in the short term and offer an additional level of safety in emergencies.
- The light weight and flexibility of the material make it easy to transport and assemble, resulting in a significant reduction in installation costs and times.



Material advantages of PP-RCT compared to steel and copper __

Made of PP-RCT, the aquatherm blue pipe system offers a sustainable and durable option compared to traditional materials such as steel and copper. This system has several advantages, including a reduced CO₂ footprint due to its lower weight and transport routes. It is durable due to the resistance to corrosion, erosion and chemical influences, while also being low-maintenance.

aquatherm blue is fused together in a precise, form-fitting manner, without the need for adhesives or burners. The two pieces of polypropylene pipe are fused into one unit, creating a permanent, leak-free connection.

In addition, it offers excellent thermal efficiency, resulting in improved energy efficiency and lower operating costs.

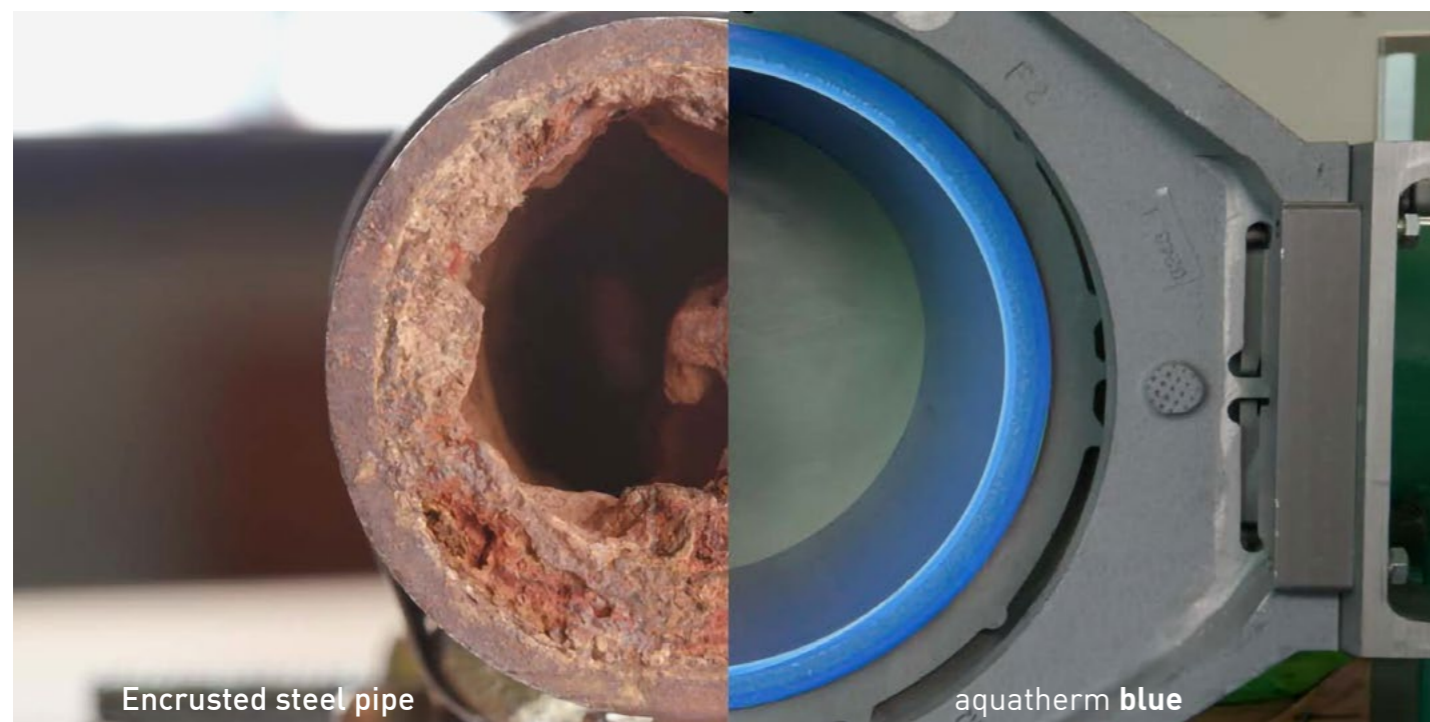
- Permanent corrosion resistance
- Adhesion-free inner surface quality
- Reduced installation and commissioning times
- Best maintenance efficiency
- High flexibility for individual adaptations and projects
- Certified according to ISO 9001, ISO 50001 and ISO 14001.

Outstanding cost-effectiveness __

The overall consideration of the costs in terms of TCO, with expenses for the pipe system, installation, maintenance and service life, shows that aquatherm blue is one of the most economical solutions for the cooling requirements of data centres.

Optimal Power Usage Effectiveness (PUE) __

Power Usage Effectiveness (PUE) is a crucial indicator of data centre energy efficiency. A lower PUE value means higher efficiency, as a greater proportion of the energy consumed directly benefits the IT systems. Cooling system efficiency plays a central role in optimising PUE, as it directly affects the use of piping systems and coolants in data centres. The use of aquatherm PP-RCT piping systems in data centre cooling and heating systems, especially in facilities with 50 kW racks, can lead to significant energy savings.



Encrusted steel pipe

aquatherm blue

aquatherm blue in action —



Novva Hyperscale Data Centre

The state-of-the-art Novva Hyperscale Data Centre in Salt Lake City, Utah (USA), which offers more than 1.5 million square metres of Data Centre space and provides power from 250 kW to 30 MW, places special emphasis on security and reliable cooling processes. The Data Centre relies on an innovative waterless cooling system to dissipate the large amount of heat generated by servers, storage, and network components.

The use of a waterless cooling system was not only made for sustainability reasons, but also to prevent the enormous water consumption of traditional cooling processes in Data Centres. In conventional systems, up to 18 million litres of water per day can be consumed, with 30 to 40% lost. At Novva, waste heat from the servers is converted into cold using a heat exchanger, eliminating the need for additional water. The entire piping system for this efficient and sustainable cooling process utilises the aquatherm blue piping system.

The decision to install aquatherm piping systems for the cooling system was made by Steven Boyce, Novva's Vice President of Infrastructure and Design. Boyce, an expert in the IT and Data Centre industry with over 20 years of experience, has struggled with corrosion issues in steel pipes in previous projects. This led to problems with sediment and rust deposits, which affected the efficiency of the system and required costly maintenance

and repairs. For this reason, he opted for the plastic piping system made of PP-RCT: aquatherm blue. The material is corrosion and incrustation-resistant, specifically tailored to the needs of the cooling sector. Fusion technology enables a secure connection of pipes and fittings, ensuring the system's long-term reliability and reducing long-term costs. In the first construction phase of Novva, approximately 1,350 metres of aquatherm blue were installed.

The biggest challenge in this project was the underfloor construction, where the floor was raised by approximately 1.5 metres to make room for piping, cables, and utilities. Thanks to Building Information Modelling (BIM), the installation could be perfectly planned, prepared and then carried out smoothly on site. Coordinating the HVAC and plumbing systems at the underfloor level, along with the floor stands on every square metre, required careful planning and implementation. In the aquatherm factory, tailor-made elements were manufactured based on the BIM data, which were then transported to the construction site ready for use.

TierPoint Data Centre, Florida

Modern data centres, such as TierPoint in Jacksonville, FL, require reliable cooling systems that work around the clock. Since 2014, TierPoint has been using aquatherm PP pipes, which are characterised by a virtually leak-free and corrosion-resistant connection. Thanks to the quick and easy installation and excellent performance, TierPoint once again opted for aquatherm for a recent expansion. The pipes provide long-lasting, energy-efficient cooling and require less insulation than steel. TierPoint plans to continue using aquatherm in future projects to ensure the safety and efficiency of their data centres.

LLNL Data Centre in Livermore, California

Since 2012, the Lawrence Livermore National Laboratory (LLNL) has been using aquatherm PP-R tubing to cool its supercomputers. aquatherm blue also impresses here with numerous advantages such as easy installation, lightness and chemical purity, without the risk of corrosion or scaling. aquatherm's fusion technology ensures a long-lasting, leak-free connection. aquatherm pipes meet stringent water quality requirements to support reliable cooling in critical applications, making them the preferred choice for the most advanced supercomputing projects.

Canadian excellence in Ontario

A Canadian manufacturer of modular data centres was looking for a lightweight and durable alternative to steel pipes for its cooling systems. aquatherm PP pipes, which weigh up to 70% less and have a service life of over 50 years, proved to be the ideal solution. These pipes were supplied prefabricated to facilitate installation and reduce transport costs. The lightweight, corrosion-resistant aquatherm pipes provide reliable cooling and simplify transport and installation, making them the perfect choice for the company's modular data centres.

Thinking outside the box: Utilising waste heat for district heating

As reported by the Borderstep Institute and ingenieur.de, data centres in Europe are consuming an estimated 87 billion kilowatt-hours of electricity, with a continuous upward trend. A significant proportion of the electricity consumed is released into the environment as waste heat in data centres. According to a study by ReUseHeat on behalf of the European Union, data centres can supply up to 50 terawatt hours of excess heat per year. This corresponds to two to three percent of the total energy demand in the EU for building heating (survey in 2020). The figures clearly indicate that expanding suitable infrastructures for 4th generation district heating holds significant potential.

The aquatherm blue pipe system allows the waste heat generated during cooling to be effectively recovered and processed for further use. An essential aspect of the value chain is transporting this heat to consumers. Here, aquatherm provides another innovative and energy-efficient solution with the aquatherm energy PP piping system. This thermally insulated pipe system makes it possible to transfer the waste heat generated in the data centre to a district or local heating network.

In contrast to the previous flow temperatures of 100 to 110 °C, modern 4th generation dis-

trict heating networks operate with significantly lower flow temperatures of 55 to 60 °C. This allows heat to be efficiently transported to households, businesses, and services, markedly reducing the demand for conventional heating energy. Dr. Ralph Hintemann, Borderstep Institute, provides another vivid example: "Theoretically, more than 10 percent of the total heating demand of the city of Frankfurt am Main could already be covered by data centres. And it is foreseeable that the waste heat from data centres would be sufficient to supply all residential buildings in Frankfurt am Main with heat in the future."

(Source: https://www.borderstep.de/wp-content/uploads/2020/09/Abwaermenutzung_Rechenzentren_2020.pdf)

Sustainability strategies of modern data centres

This article shows the responsibility and possibilities of planners, operators and also users of data centres to minimise the ecological footprint and integrate sustainability principles. Overall, this requires a holistic approach that includes both technological innovations and strategic decisions. Here is an overview of the future strategies that are already being incorporated into the design and implementation of new data centres.

- **Sustainable construction methods**

The use of environmentally friendly, recyclable building materials and ecological aspects such as resource consumption during the construction phase are just as crucial.

- **Heat recovery and efficient use**

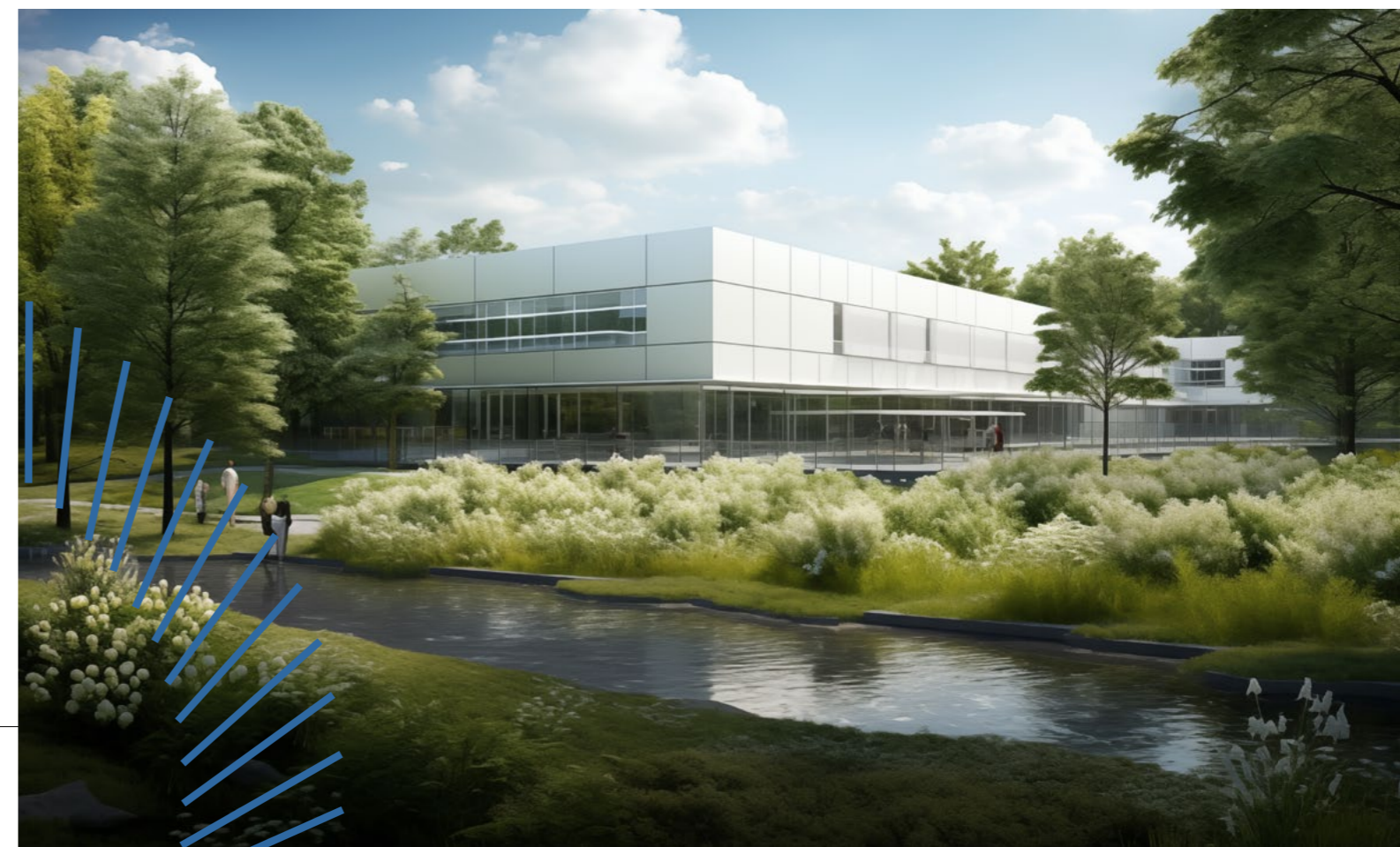
Heat recovery from the operation of the racks offers - as explained in detail here in the article - an excellent opportunity to increase energy efficiency and reduce energy consumption.

- **Scalable and modular design concepts**

By building scalable and modular data centres, resources can be used more efficiently and oversizing can be avoided.

- **Transparency through green certifications**

aquatherm's pipe solutions are certified or documented in Environmental Product Declarations (EPDs) to meet these sustainability requirements.



Result __

Data centres serve as the foundation of digitalisation and our networked society. To ensure their long-term safe operation, PP-RCT pipe systems like aquatherm blue are indispensable. These state-of-the-art plastic pipes not only address the challenges of climate change but also offer exceptional solutions in terms of efficiency and durability.

The flexibility and adaptability of aquatherm blue, along with the system's low weight and the ease and speed of installation using prefabricated units, ensure seamless integration into both new and existing data centre infrastructures.

Unlike traditional pipe materials such as steel or copper, plastic systems are rust-free.

Modern pipe systems made of PP-RCT set new standards in maintenance, reducing the total cost of ownership throughout the entire service life of the plant.

This article has demonstrated the comprehensive benefits of aquatherm PP-RCT piping systems, providing a solid foundation for informed decision-making focused on long-term resilience, efficiency, and sustainability.





aquatherm GmbH

Biggen 5 | 57439 Attendorn | Deutschland
Tel: +49 2722 950 0 | Mail: info@aquatherm.de

Status: 05.2024



Part of the Solution
www.aquatherm.de