Grundfos Data Center Solutions

Distributed Pumping

Efficient water solutions
for effective data flow

Copenhagen April 2026

GRUNDFOS

Possibility in every drop

Agenda

- Who we are
- Sustainability at Grundfos
- Distributed Pumping
- Modular Build

One of the world's leading pump and water solutions companies

21,000+
employees

87.6%
owned by the Poul Due Jensen Foundation

€4.5
$5bn
revenue in 2025

5%
of revenue invested

16,000,000
units produced per year

1945
when it all started

Saving energy
through smarter and more efficient pump technology

Saving water
through developing water-efficient and water reuse solutions

Embedding
Circular business
Principles throughout our organisation

Providing
Water access
to people in need

Sustainability is at the heart of everything we do

6 CLEAN WATER AND SANITATION

13 CLIMATE ACTION

We are the first water solutions company with a Science-Based Target approved Net Zero Goal

By 2030

Reduce absolute scope 1 and 2 scopes Greenhouse Gas (GHG) emissions 50%

Reduce absolute scope 3 GHG emissions 25%

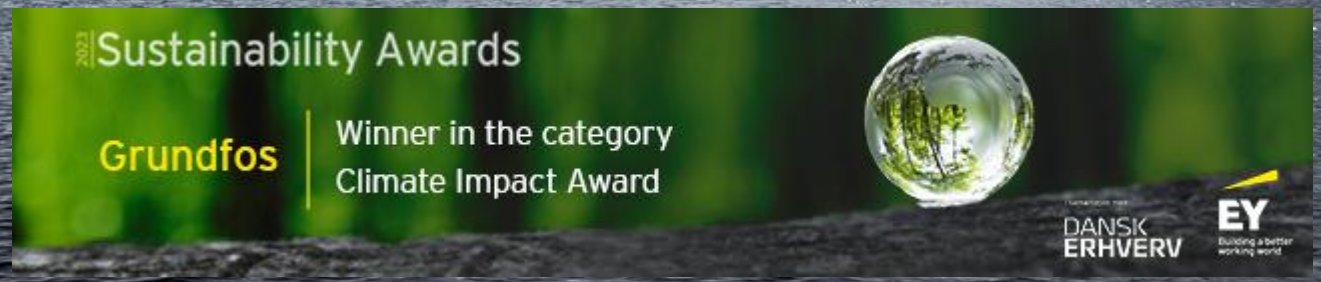
By 2050

Reduce absolute scope 1, scope 2, and scope 3 GHG emissions 90%

SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

Approved science-based net-zero targets

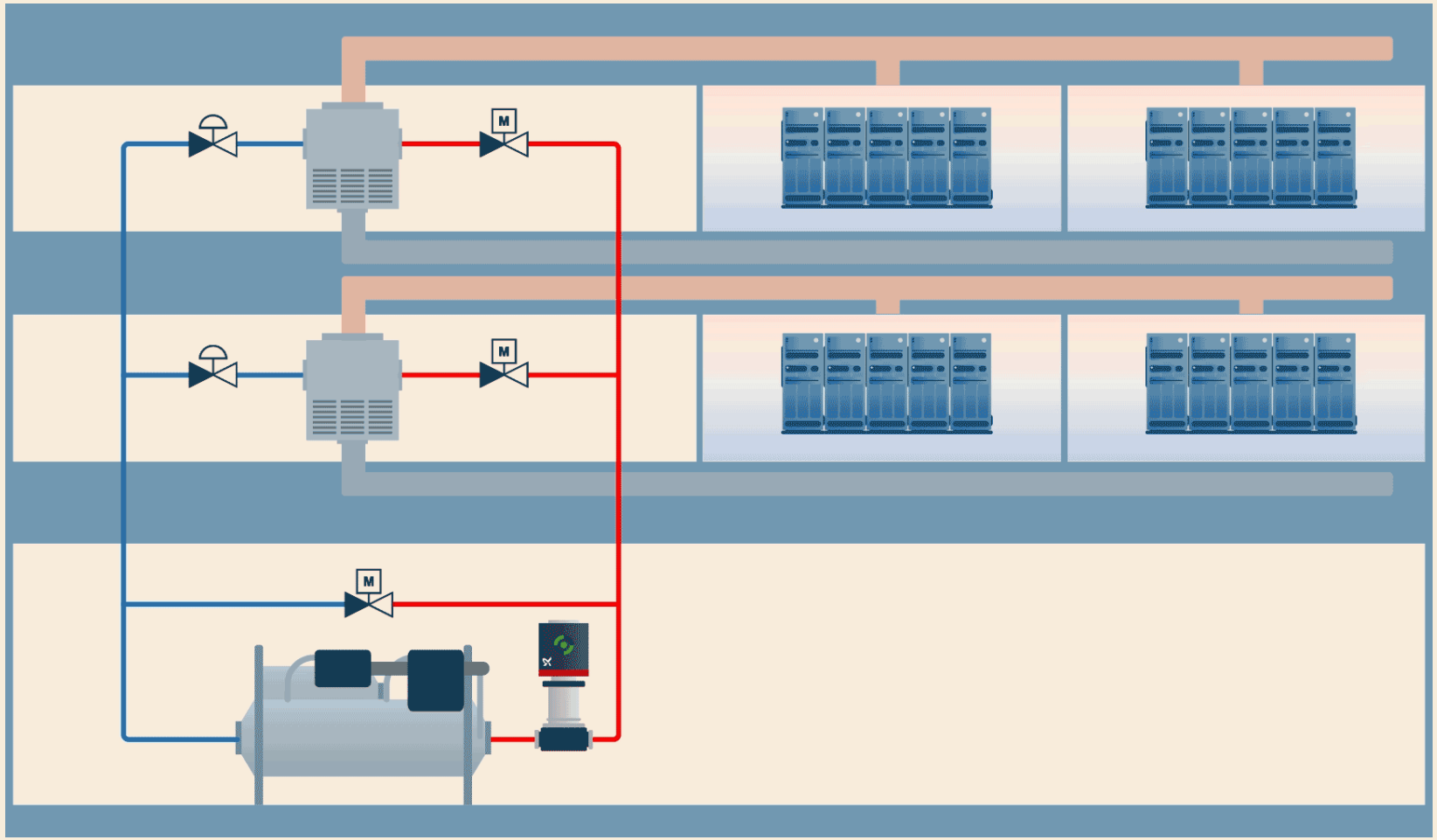


Data Centre Cooling

- The data centre industry is experiencing accelerated growth driven by the demand for operational capacity in all regions.
- Demand is driven by the rapid expansion of AI, Machine Learning, HPC, and Cloud Computing.
- The processing power of GPU's, their power and cooling requirements is challenging and changing the data centre landscape.
- Traditional Air Cooling Technologies are no longer capable of satisfying these cooling needs.
- Air cooled, Liquid Cooled and Hybrid Data Centres coexist and the infrastructure to support these cooling needs in changing.
- Distributed pumping is a flexible and versatile solution to many evolving cooling needs.

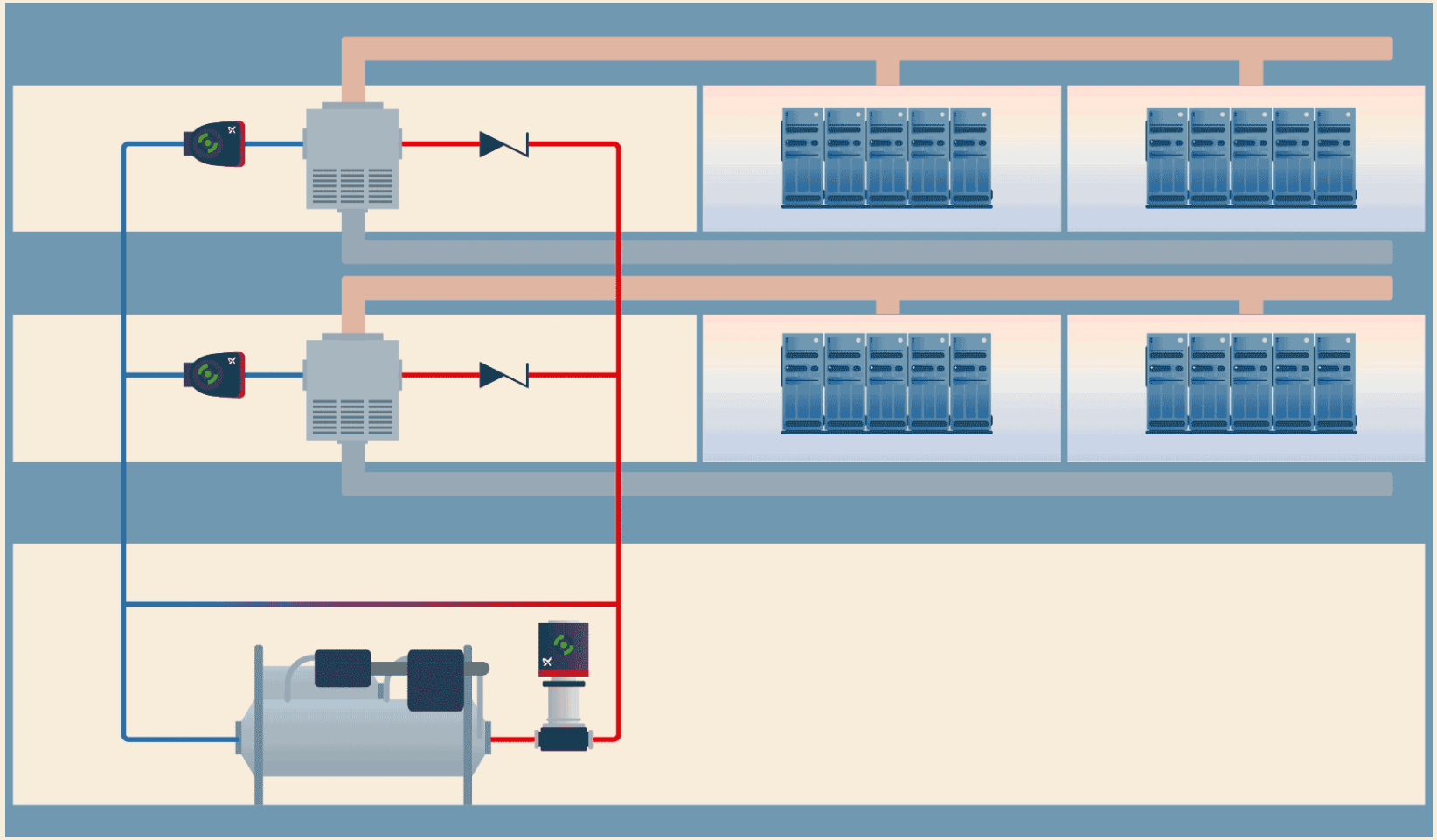
Dynamic flow control in Data Centres.

- Chilled water is produced by chillers or other sources.
- The balancing and modulating valves regulate flow to the CRAH/CDU units.
- Modulating valves regulating chilled water flow create back pressure, consuming energy.



Dynamic flow control in Data Centres with a distributed pumping

- We remove the control valves where possible and replace them with intelligent pumps to control the flow.
- The back pressure is eliminated, and energy is saved.



Traditional Design

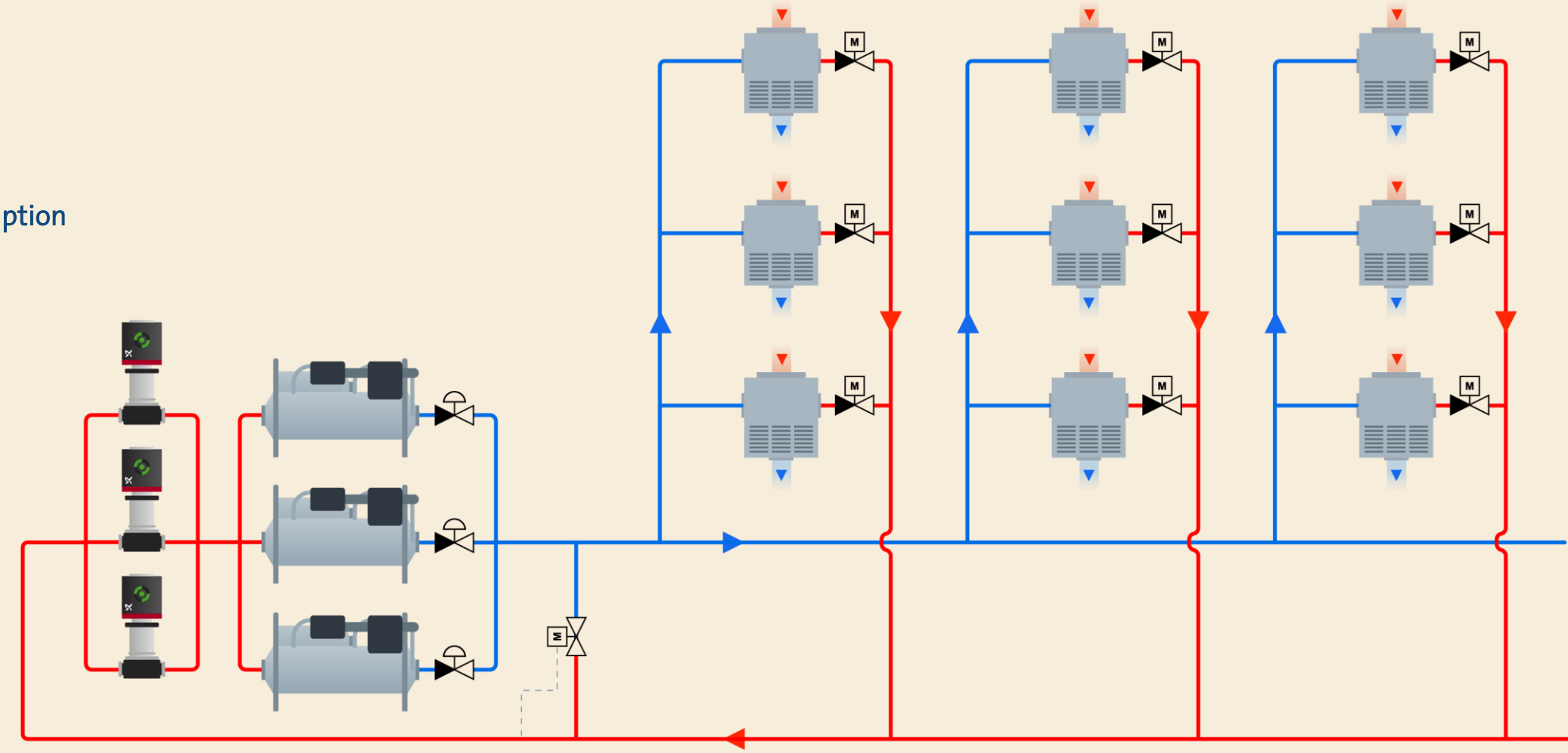
The variable primary circuit

Advantages:

- Lower capital cost
- Saves space
- Reduced power consumption

Disadvantages:

- Complex Design
- Risk of bypass malfunction
- Difficult to commission
- Difficult to define index circuit



Traditional Design

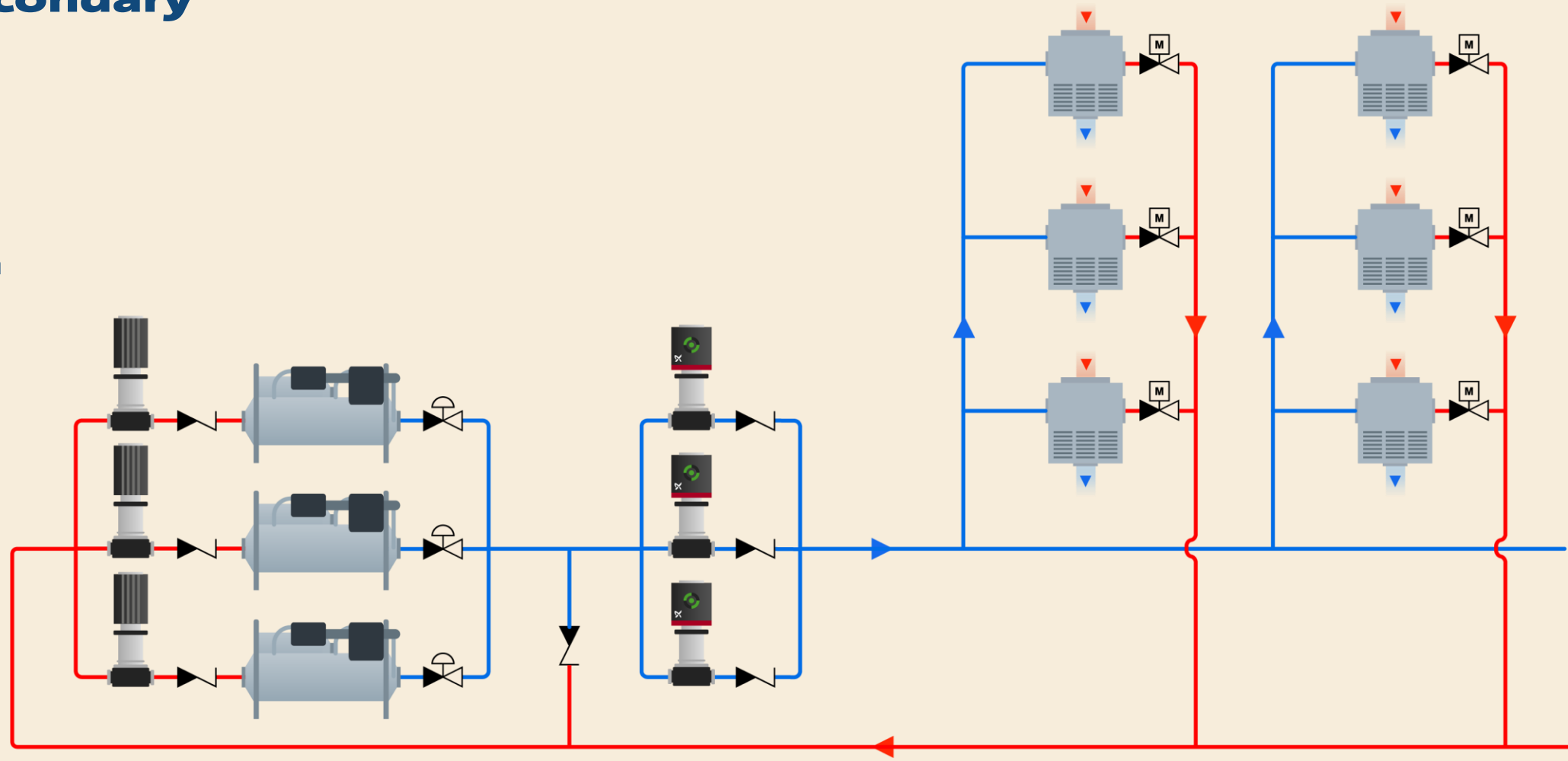
The constant primary/ variable secondary circuit

Advantages:

- Easier to design
- Easier to commission
- Easier to balance
- Easier to maintain

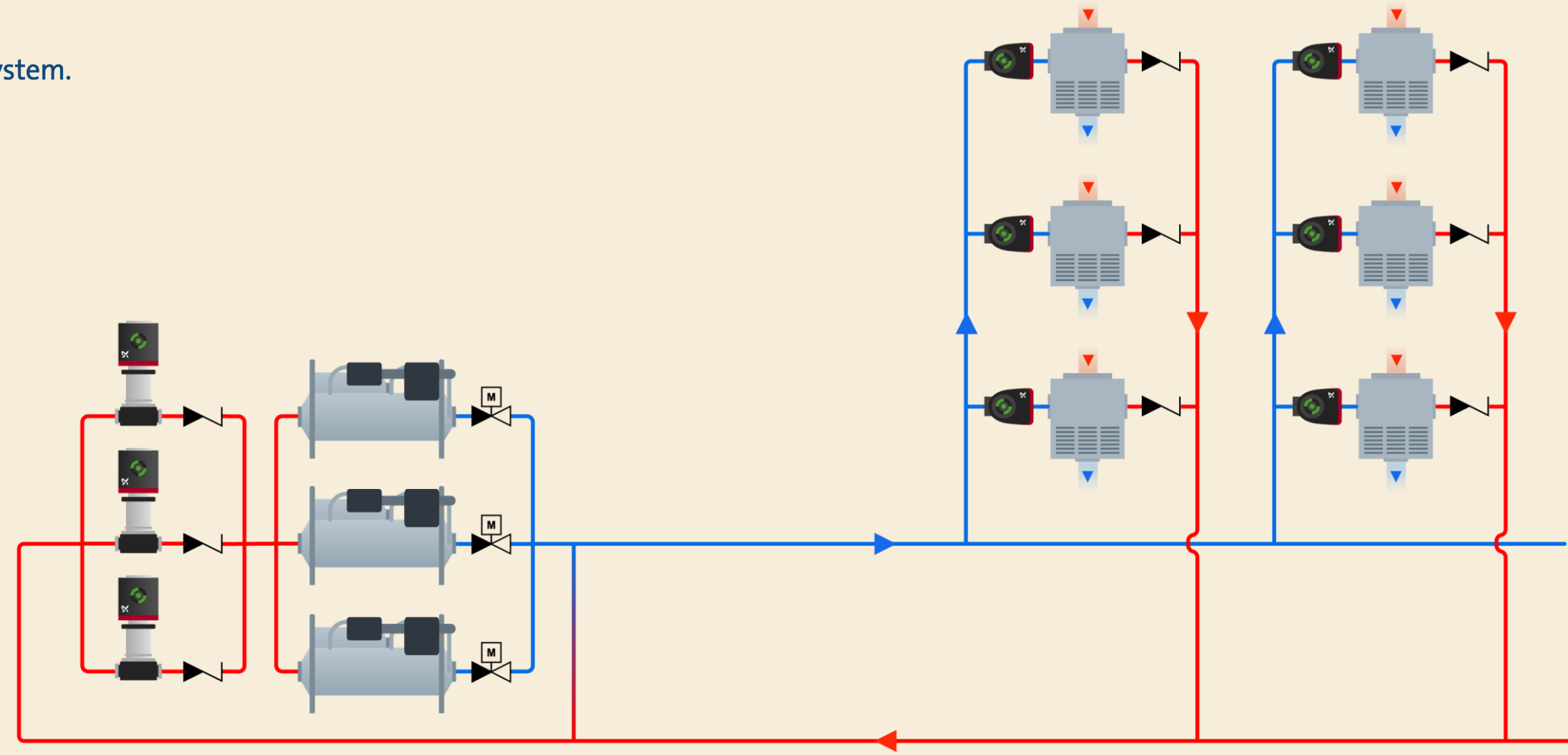
Disadvantages:

- Higher capital cost
- More space required



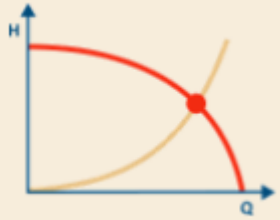
Distributed Pumping Design

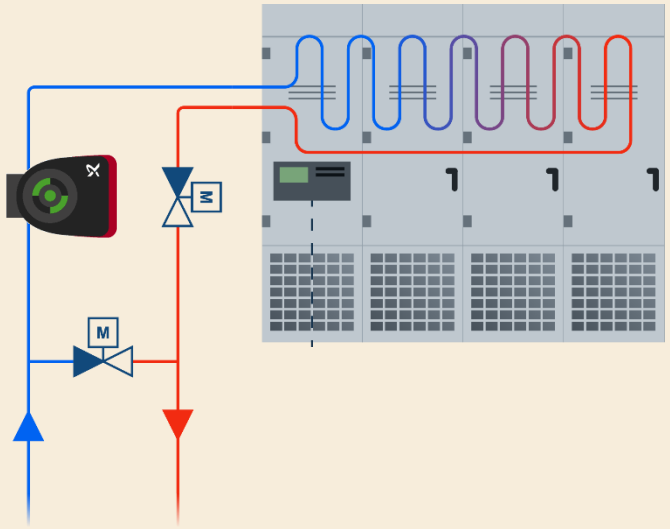
The constant primary/ variable secondary as a distributed pumping system.



Removing unnecessary modulating valves

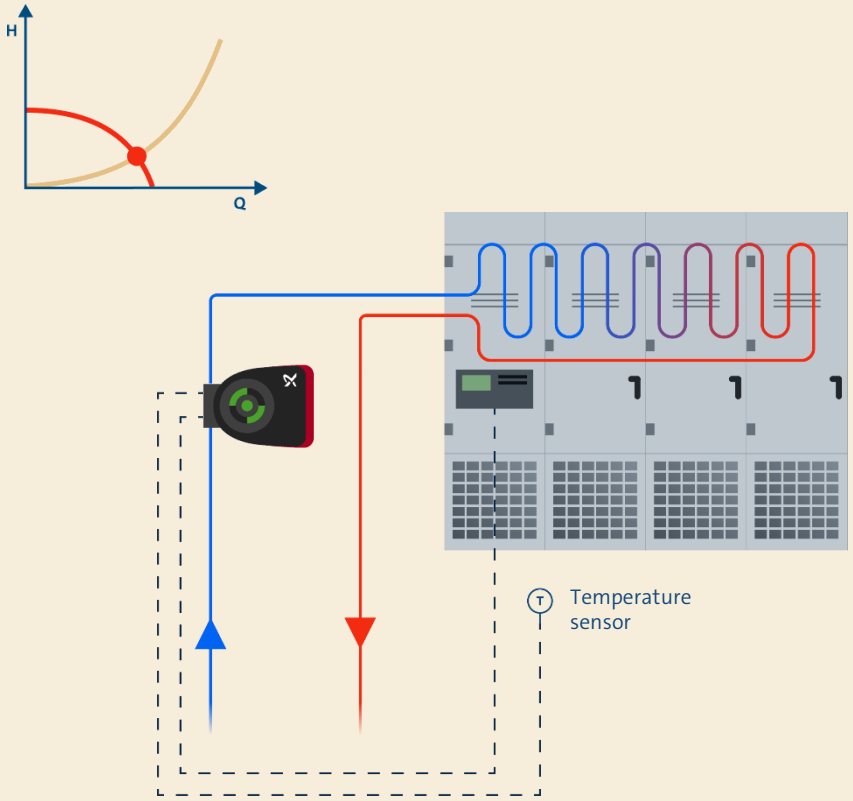
- A traditional system might look like this.
- Cooling liquid flow is controlled by a series of valves, increasing and decreasing the flow to meet the cooling needs of the system
- This control is reliable and effective, but not the most energy efficient.





Removing unnecessary modulating valves

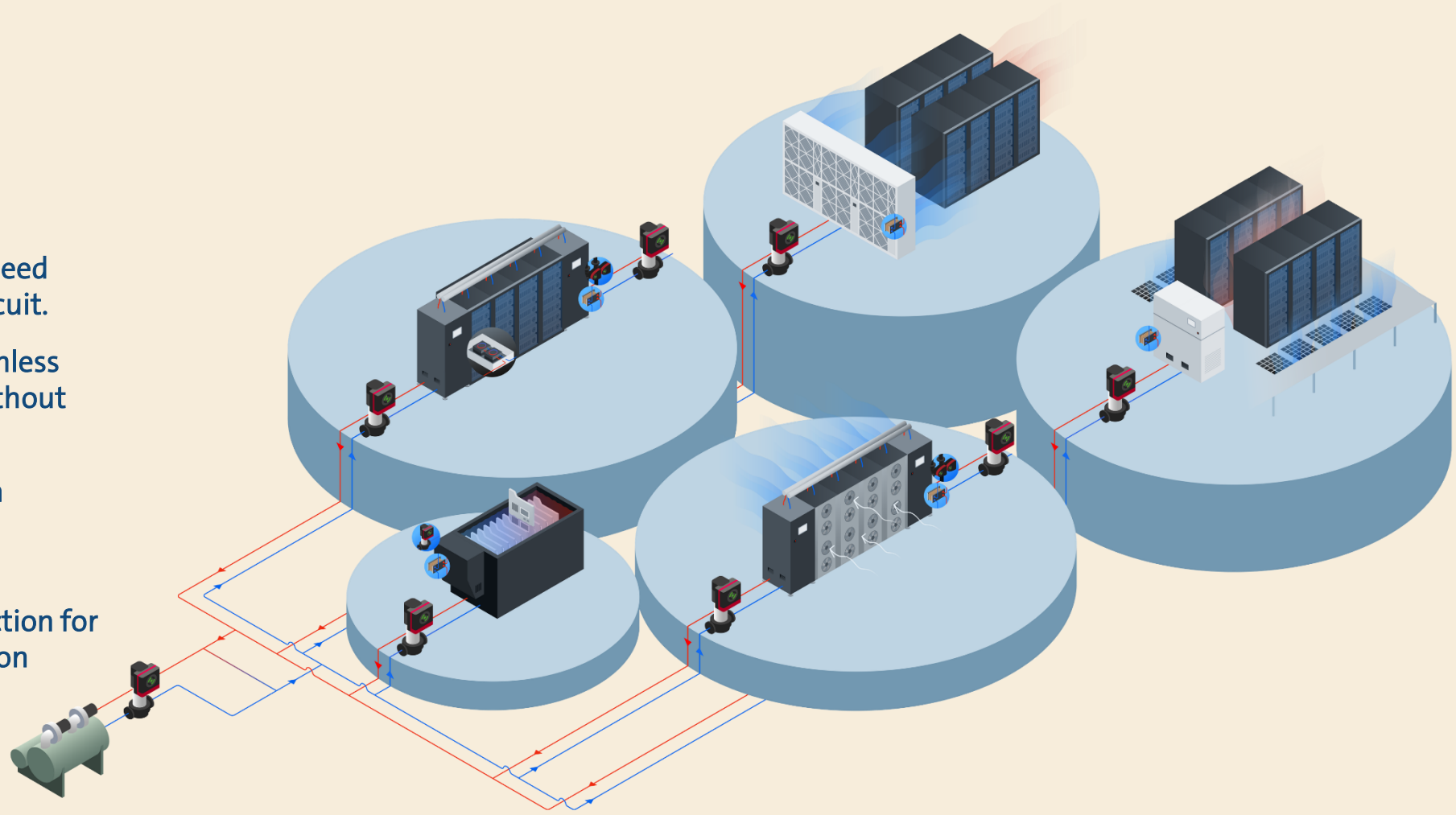
- We remove the control valves where possible replacing them with intelligent variable speed pumps.
- These pumps can be controlled in different ways.
- The pumps have built in control modes suitable for temperature control.
- We can use temperature sensors (air or liquid) to control the pump.
- We can use the CRAH/CDU/FWU controller to control the pump.
- We can use the BMS to control the pump.



Distributed Pumping

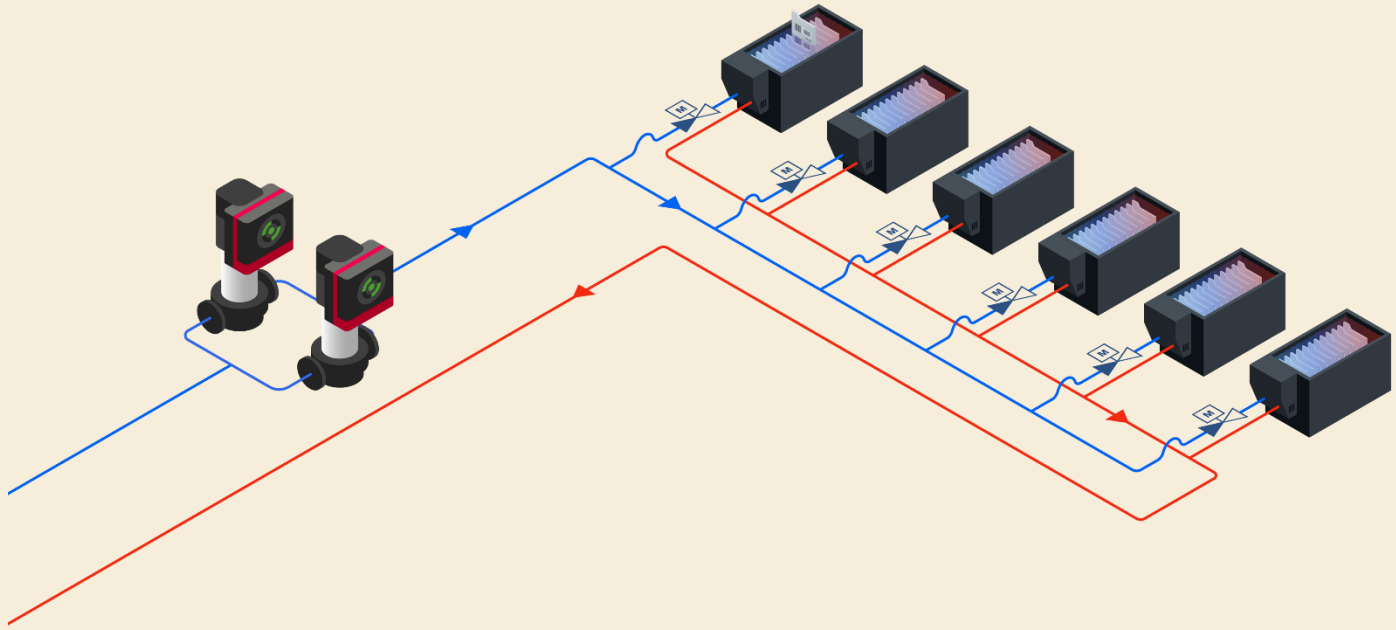
Advantages:

- Simplified design process.
- Decoupled system, reducing the need to determine the critical index circuit.
- Modular design, allowing for seamless integration of new equipment without impacting existing systems.
- Design performance ensured with Grundfos' recommended control methods.
- Grundfos handles sizing and selection for all coil and primary pumps based on provided piping schematics and equipment information.



Zoned Distributed Pumping

- Zoned distribution is used in applications where full distributed pumping might not be suitable.
- With zoned distribution the cooling loads are organised in zones, supplied by their dedicated distributed pump or pumps.
- This gives the benefits of distributed pumping with the option of duty stand by pumps for redundancy.
- This approach can be applied in various configurations depending on the application and redundancy requirements.
- Zoned distribution gives the he benefits of managing the ΔT, modularity, with some compromise on the reduction in system friction losses to facilitate practical redundancy solutions.
- Distributed pumping facilitates Hybrid cooling solutions in data centres.

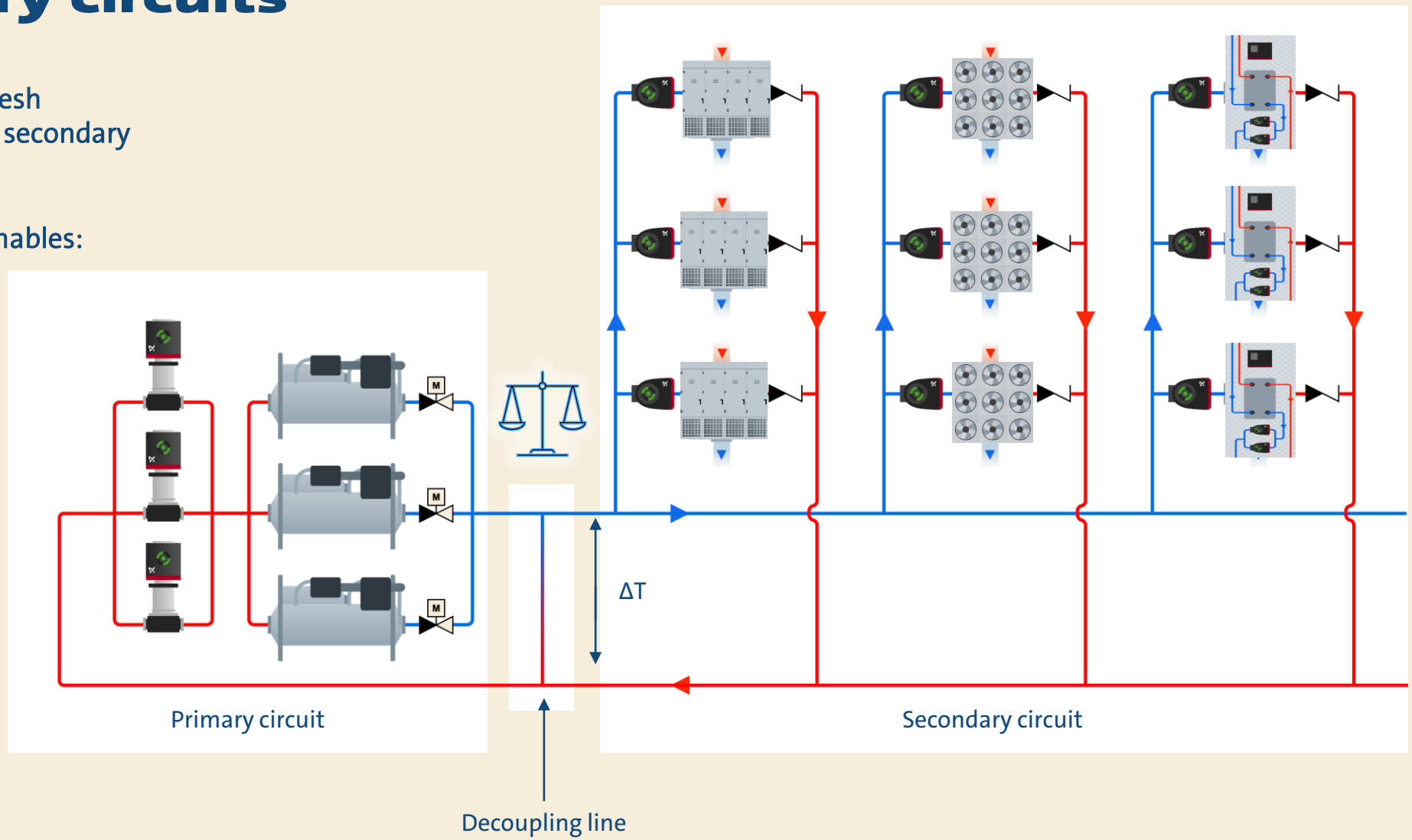


Balancing the primary and secondary circuits

Distributed Pumping offers a fresh perspective on the primary and secondary circuits.

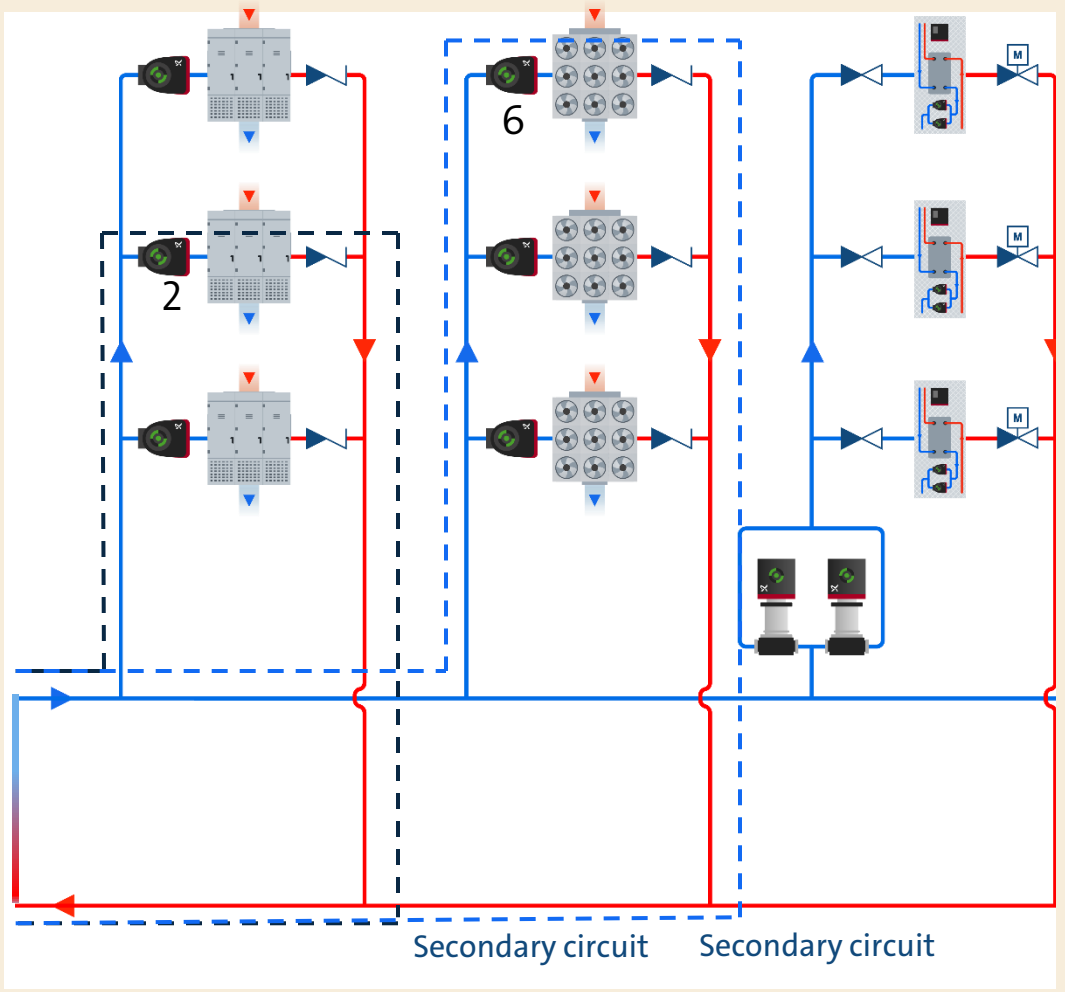
Utilising the decoupling lines enables:

- Control over the primary and secondary circuits.
- Optimisation of the balance of both circuits.
- Control of the system's Delta T.



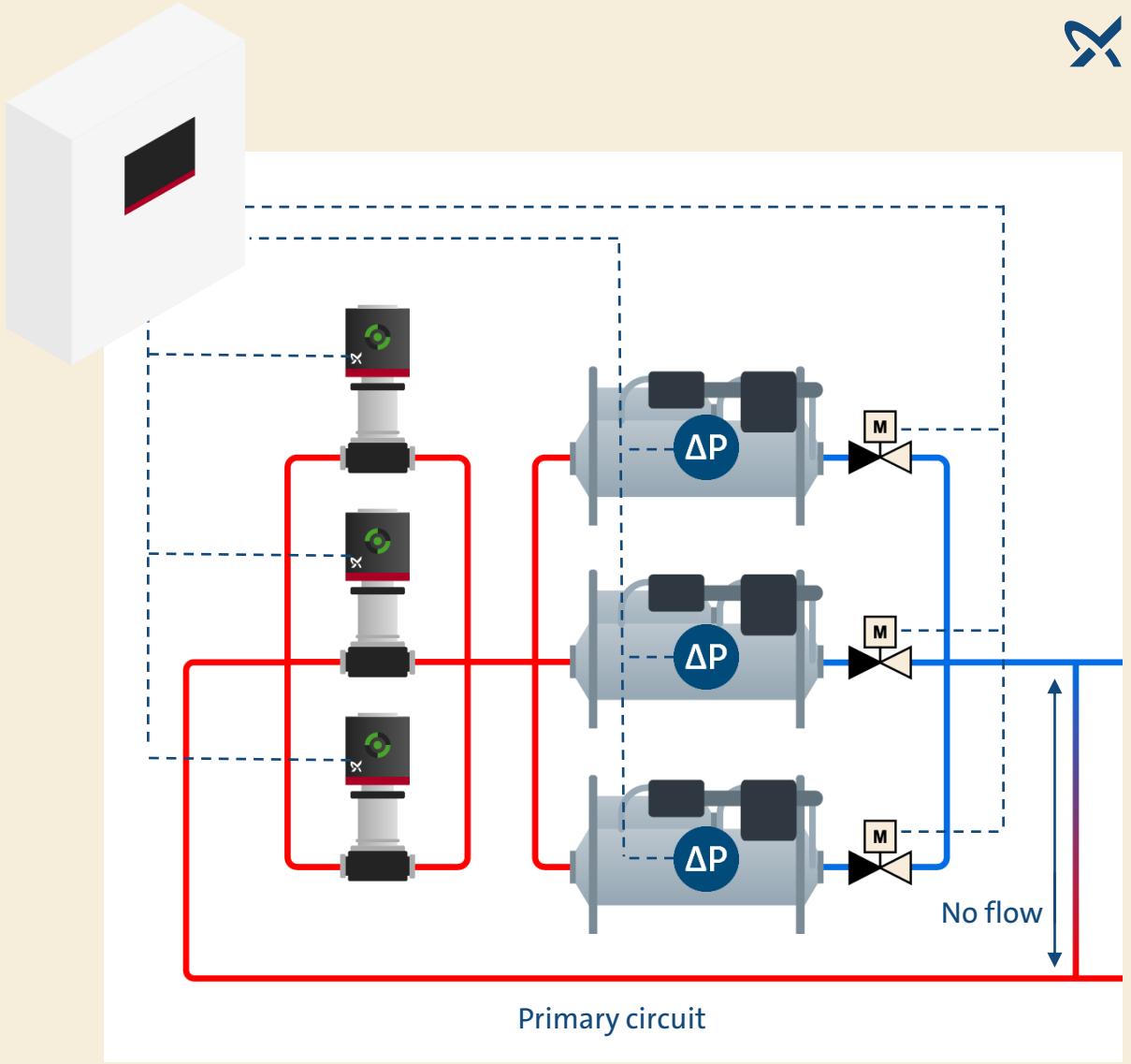
Balancing the secondary circuit

- Distributed pumps on the secondary circuit autonomously manage loads of the CRAH or CDU's or Zones they serve.
- Each pump is sized for the load and pipe run serving application (CRAH/FW/CDU or Zone).
- The pumps modulate flow based on circuit sensor feedback.
- The pumps adjust speed to precisely match the chilled water needed for the application.
- Constant communication between pumps and sensors ensures balanced circuits.
- Adding circuits doesn't disrupt system balance as the pumps adjust based on circuit feedback.



Balancing the primary circuit

- The primary circuit is controlled differently using the Grundfos MPC Controller (GENECON).
- Safety of the chiller is a priority, and it is monitored by signals from the chiller control valve.
- Differential pressure sensors across chillers ensure flow rates meet minimum requirements.
- If the minimum flow isn't met, the speed of the primary pumps is increased to meet requirements.
- Once the minimum flow is ensured, the flow between the primary and secondary circuits is balanced.
- The secondary circuit should provide enough chilled water to meet the load on the CRAH/CDU units.
- The primary circuit must provide the chilled water required to meet this demand.
- The ideal situation is for no flow to be in the bypass (decoupling line).



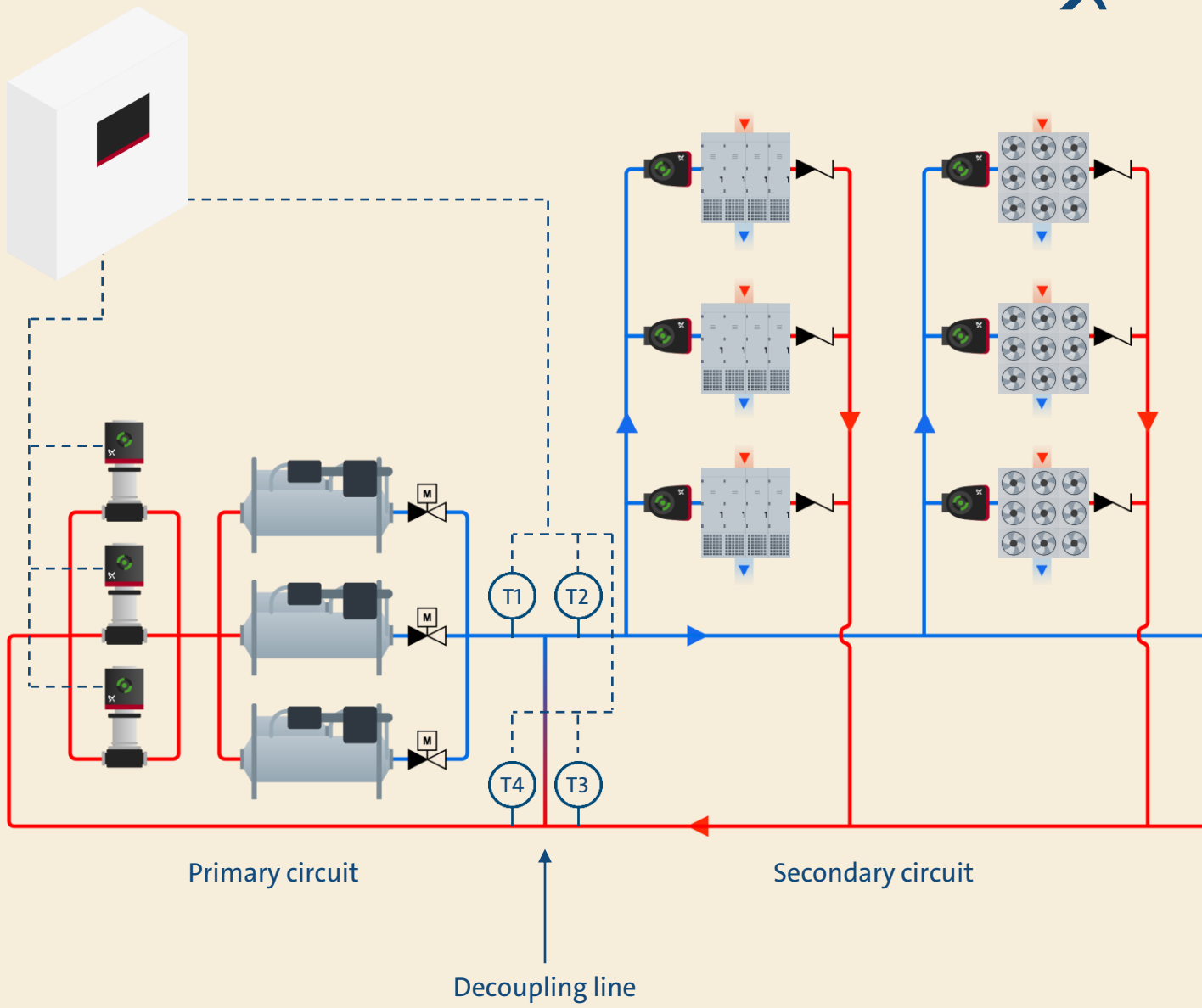
Primary circuit

Balancing the primary and secondary circuits

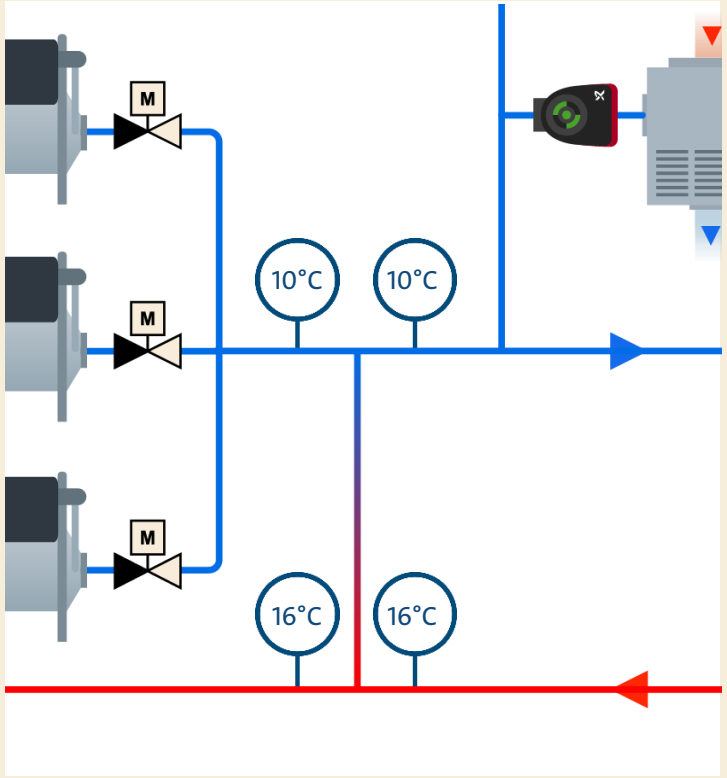
- To balance the flow across the primary and secondary circuits, temperature sensors must be installed on both the primary and secondary loops.
- The differential temperature between T4 and T1 should be compared with the differential temperature between T3 and T2.
- A balanced system can look one of two ways:

  (T4-T1) = (T3-T2)

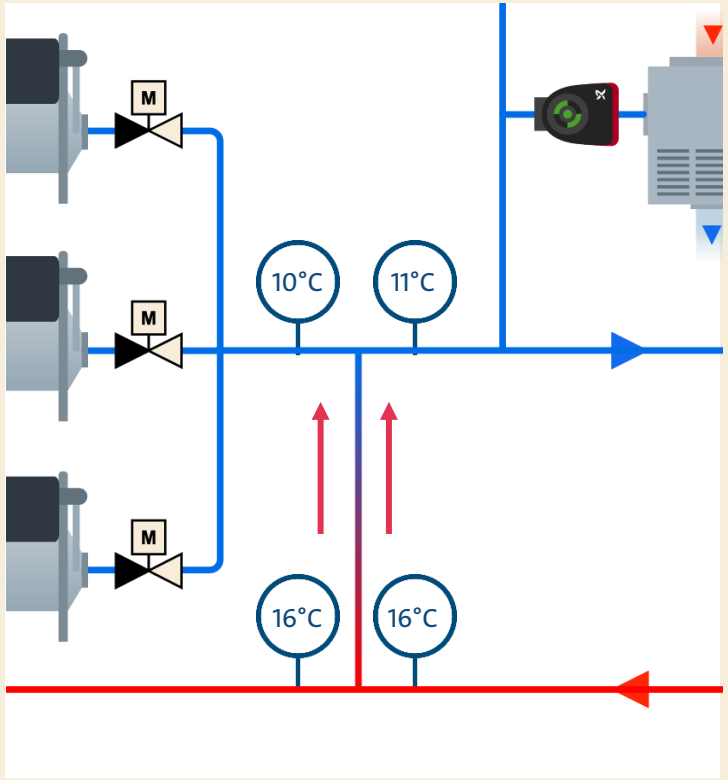
  T1=T2 and T3=T4
- If they don't match, the system is imbalanced and flow will be in the bypass/decoupling line.
- The MPC Controller adjusts the speed of the primary pumps to balance the flow and deliver the required chilled water.
- When the circuits are balanced, the required amount of chiller water on the secondary side is produced. This optimises energy use and chiller efficiency.



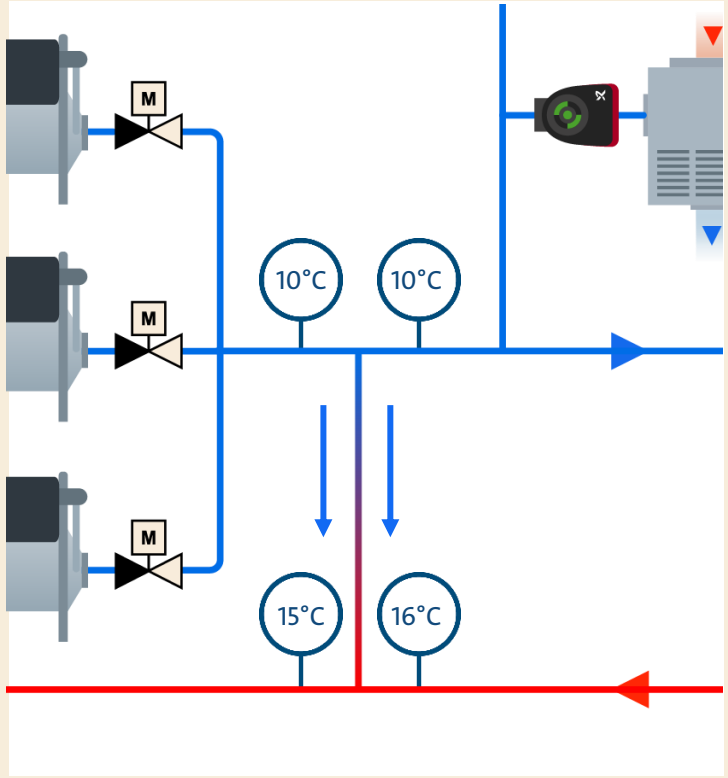
Balancing the primary and secondary circuits



When T1=T2 and T3=T4, the primary and secondary circuits are balanced and there will be no flow in the bypass/decoupling line.



If T2 is greater than T1, there will be flow from the hot water return line through the bypass. This is due to under pumping. When this happens, the speed of the primary pumps is increased.



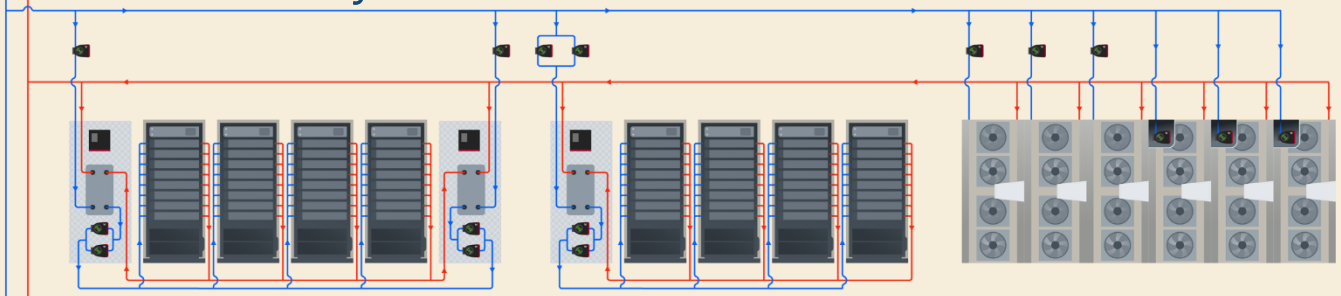
If T4 is less than T3, there will be flow from the supply line through the bypass. This is due to over pumping. When this happens, the speed of the primary pumps is decreased.

HOW DO WE COMPLETE THE JIGSAW

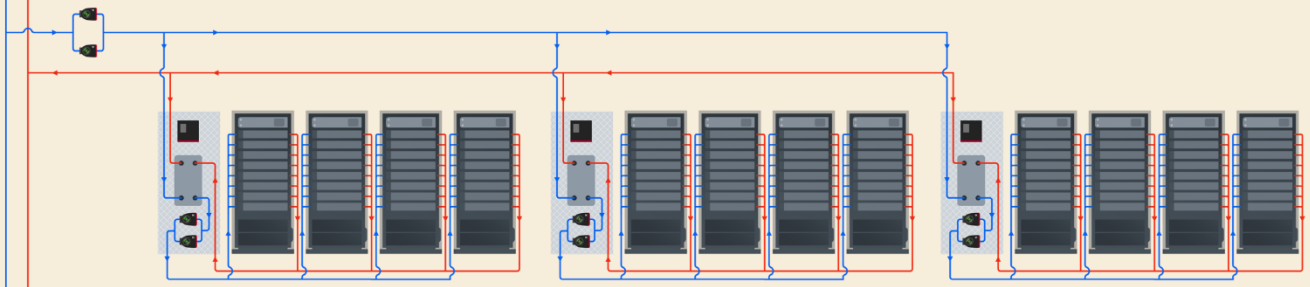
Hybrid Cooling

Distributed pumping with CDU redundancy

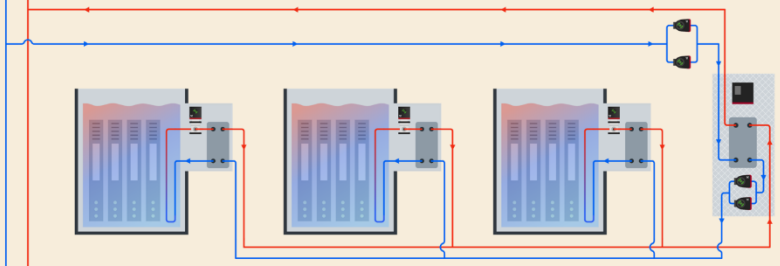
Twin-pump set (redundancy)



Rear door heat exchangers / OEM



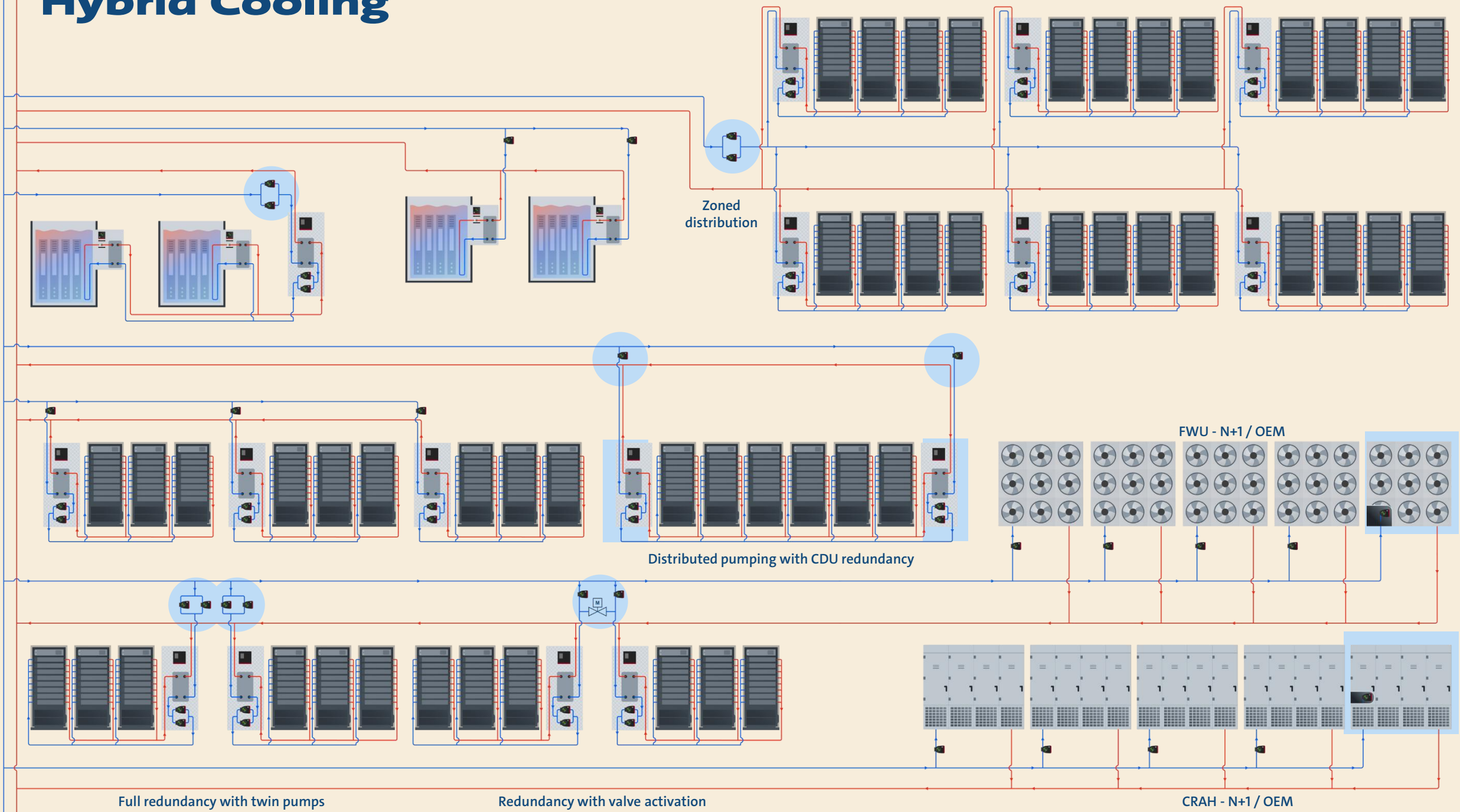
Zoned distribution / distributed pumping



Immersion cooling

Hybrid Cooling

Hybrid Cooling



Distributed Pumping

What are the benefits?

- Reduces pumping energy consumption.
- Balances primary and secondary circuits.
- Optimises the Delta T.
- Facilitates modular design.

Using Distributed Pumping results in an automated and more efficient system that has a better balanced and more controlled Delta T.

Workflow

Data centre project

Pipe layout and schematic

Equipment schedule for chillers, pumps, terminal loads

Assessment on feasibility

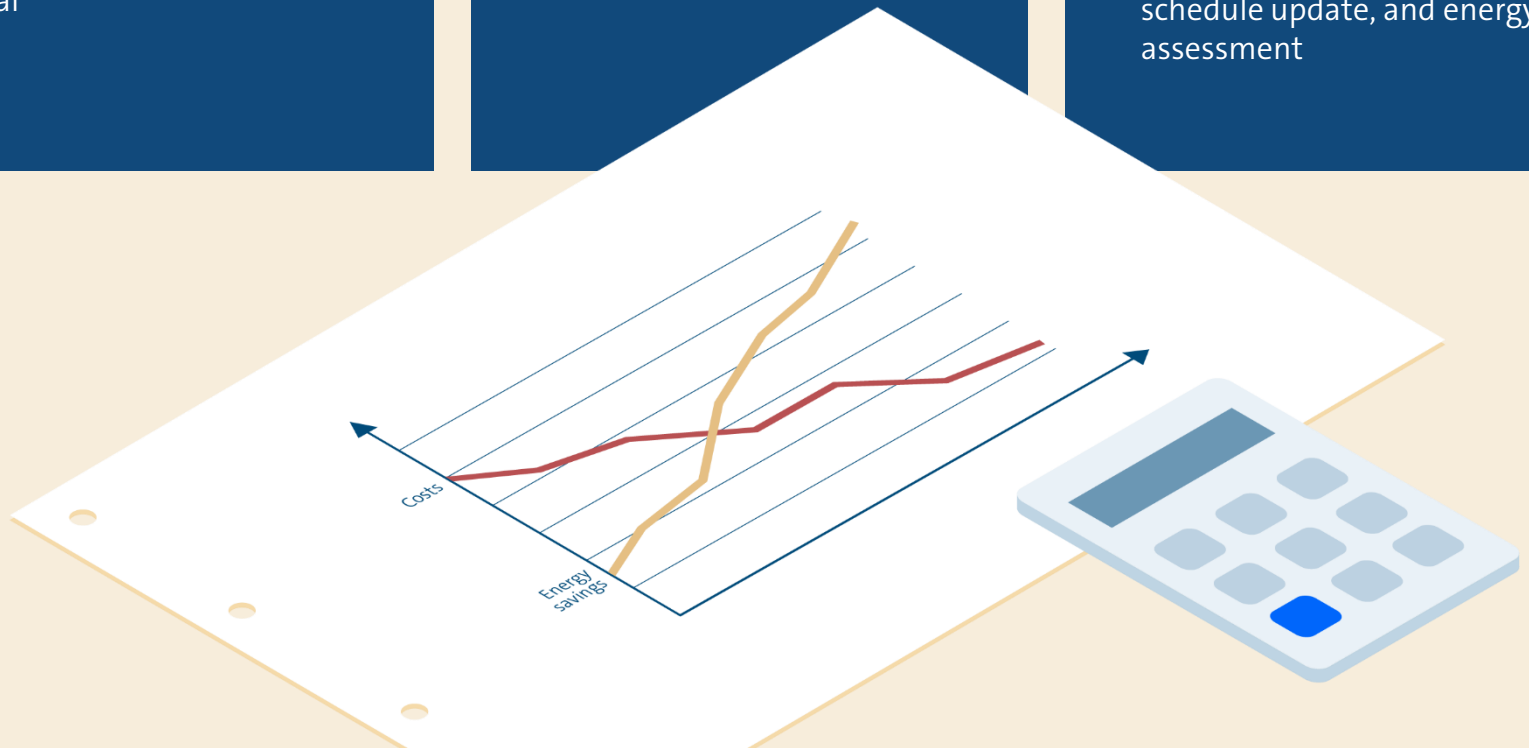
Quick assessment on project scope and fit based on complexity, risk, time and legal

Project sizing and selection

Grundfos engineers size according to requirements and design

Project documentation delivery

Handover of distributed schematic, equipment schedule update, and energy assessment



Case Study

- 3.3 MW facility in IMEA. Chillers, CRAH units, and fan walls needed.
- Original design suggested was a variable primary chilled water system, using:
  10 NK 100-315 – 30 KW Pumps (N+2)
- Estimated energy consumption from the variable primary system:
  672,130 kWh
- Distributed pumping installation suggested:
  10 primary pumps – TPE 125-190/4 – 11 KW (N+2)
  66 TPE pumps 0.55 KW to 4 KW
- Secondary pumps controlled from the CRAH Units.
- Estimated energy consumption from the distributed pumping system:
  392,904 kWh

Total estimated savings:

279,226 kWh

MAGNA3 and TPE3

MAGNA3

HIGH EFFICIENCY

High efficiency motors (IE5) and integrated Variable Frequency Drive ensures high efficiency at any load.

ENERGY-OPTIMISING ALGORITHMS

Algorithms like flow limit and minimum pressure ensure energy efficient distribution.

PATENTED SENSOR

Patented Delta P and T sensor minimises energy losses.

OPTIMISED PUMP HYDRAULICS

The pumps' hydraulics have been optimised for optimal flow conditions.

TPE3

MODbus

STANDARD PRODUCTS

Energy Efficient Water Solutions

Efficient water solutions for effective data flow

Energy Efficient Water Solutions for cooling

Our solutions help Data Centres by bringing down the PUE and WUE to the most ambitious sustainability targets.

Source

Whatever your water source, we have an efficient system to get your water to where it is needed.

At the right flow, at the right pressure and at the right time.

Treat

We ensure your water source is of the correct quality for your distribution systems.

In the most efficient way, utilising fewer chemicals, reducing waste, whilst maximising quality.

Distribute

Within water distribution, ensuring the right flow, at the right pressure, at the right delta T and at the right time is our prerogative.

Doing it in the most energy - efficient and water-saving way is our mission.

Discharge

Maximising water reuse in your systems and minimising waste is our focus within the discharging process.

Therefore, our drainage systems can be incorporated into rainwater harvesting units or water reuse systems.

Our expertise

1. Consultation & design

2. Sizing & planning

3. Engineering & production

4. Installation Supervision

5. Commissioning

6. Operation Training

7. Maintenance

8. Monitoring Metrics

Contact

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GRUNDFOS

Possibility in every drop