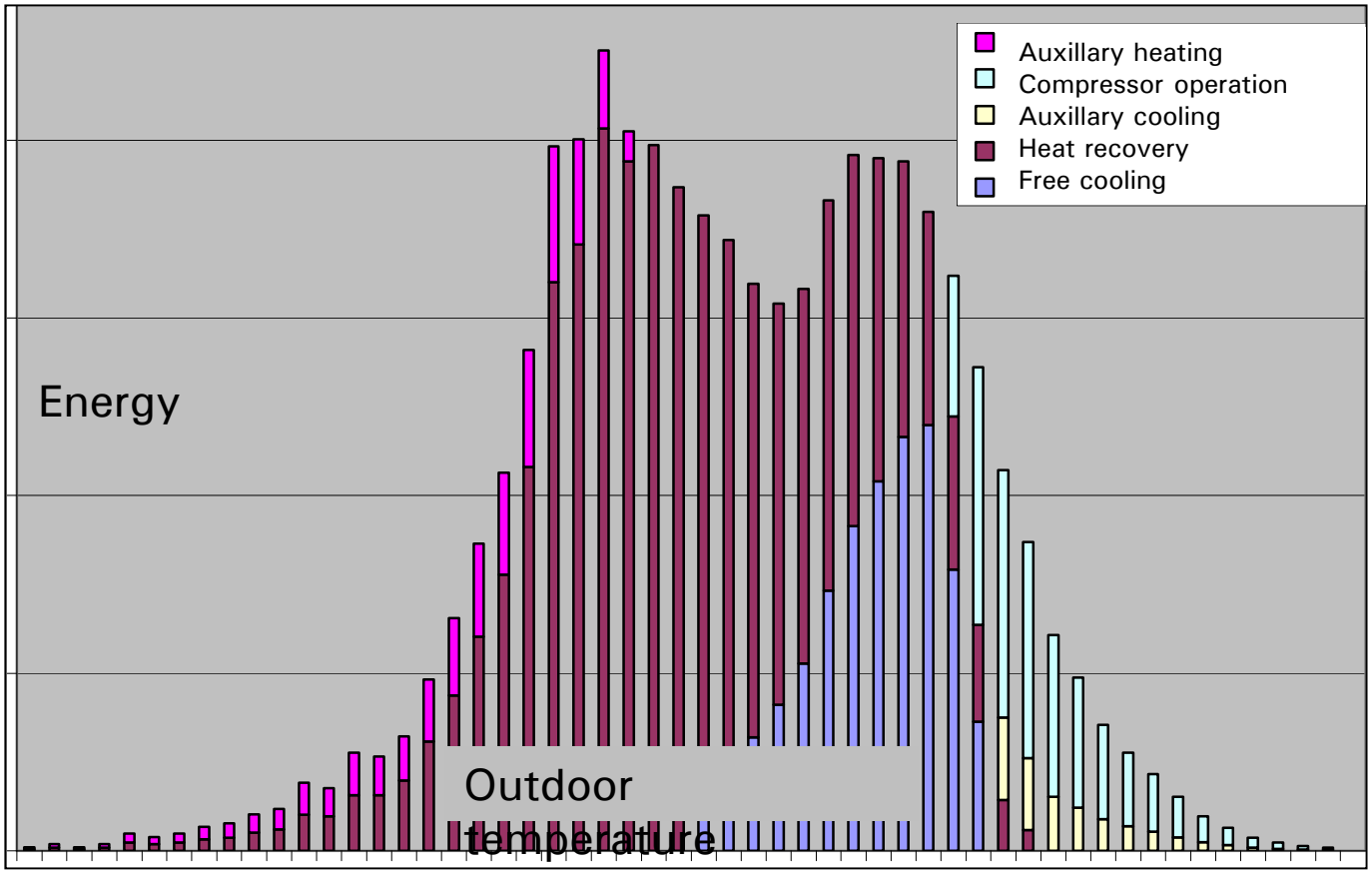
Server Room Heat Recovery
and
Free Cooling with CO_2 and Propane



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Project Organisation

Funding

The Danish Energy Association

Partners

Danish Technological Institute

Carrier Refrigeration Denmark

Danish Technical University

FlexCoil (subsidiary of Evapco)

Alfa Laval

Plant Host and Investor

EnergiMidt

The Office Building of EnergiMidt

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View of the hall

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Need to have

- Building
- Heating system
- Hot tap water preparation
- Ventilation system
- Canteen kitchen refrigeration system
- Server room cooling system
- Server room cooling back up

- Low operation costs

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Nice to have

- Low energy building concept
- Natural refrigerants
- Heat recovery
- Free cooling
- Natural and mechanical ventilation system
- PV panels

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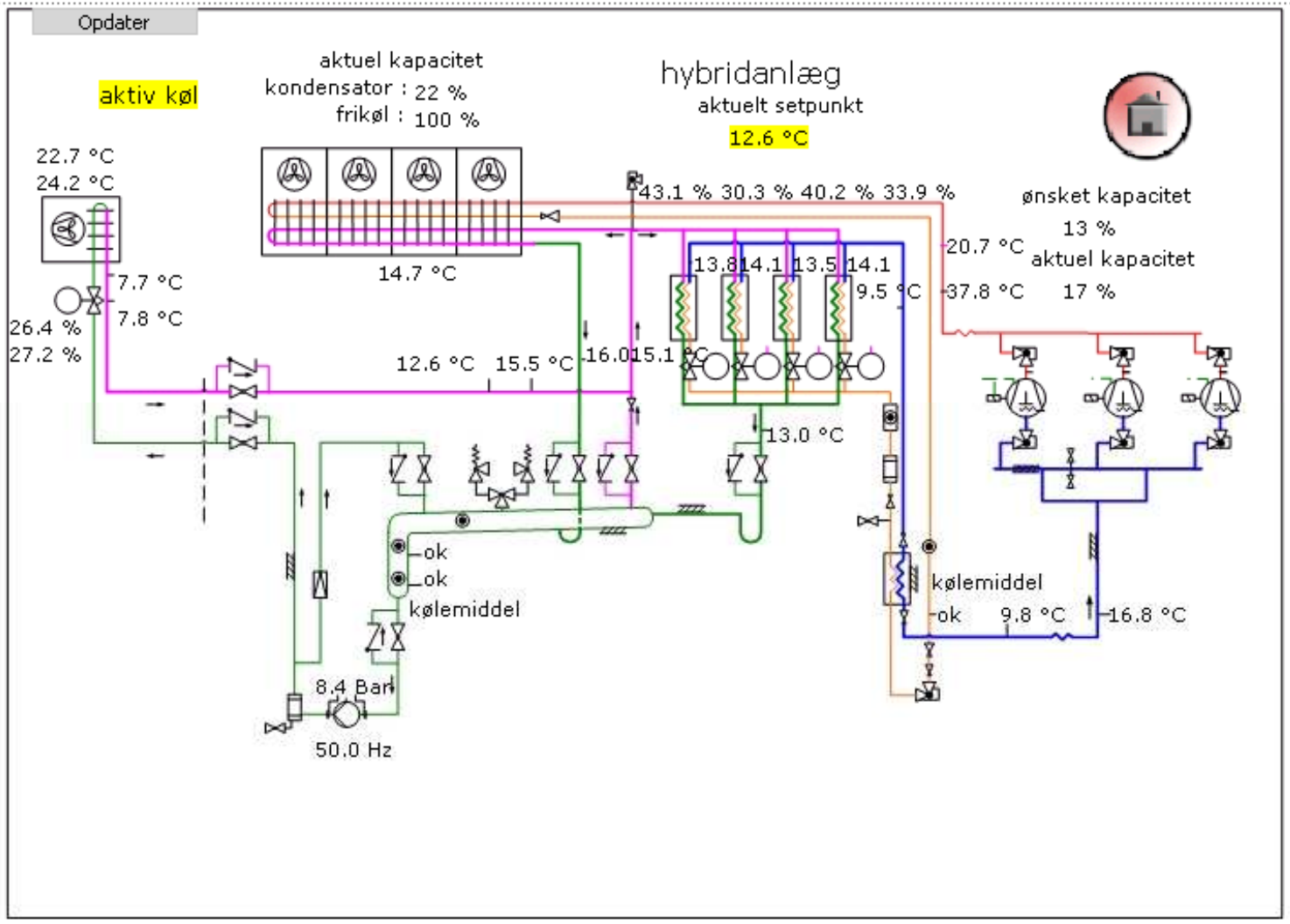
Capacities

- Server room Heat Load 150 kW
  - Propane/ CO_2 system 100 kW
  - Glycol chiller 100 kW
  - Heat Recovery Coil 100 kW
- Canteen kitchen refrigeration 20 kW
- Heat Pump Heating 120 kW
- Heat Pump Hot Tap Water 20 kW

Screen dump from BMS system



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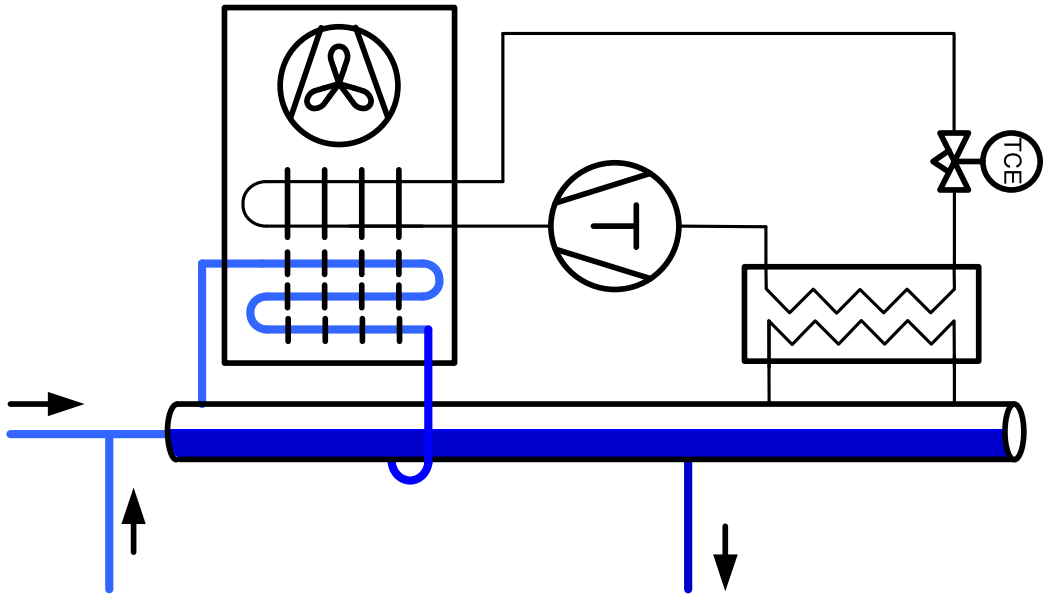
Server room cooling modes

- Low ambient temperature CO_2 free cooling



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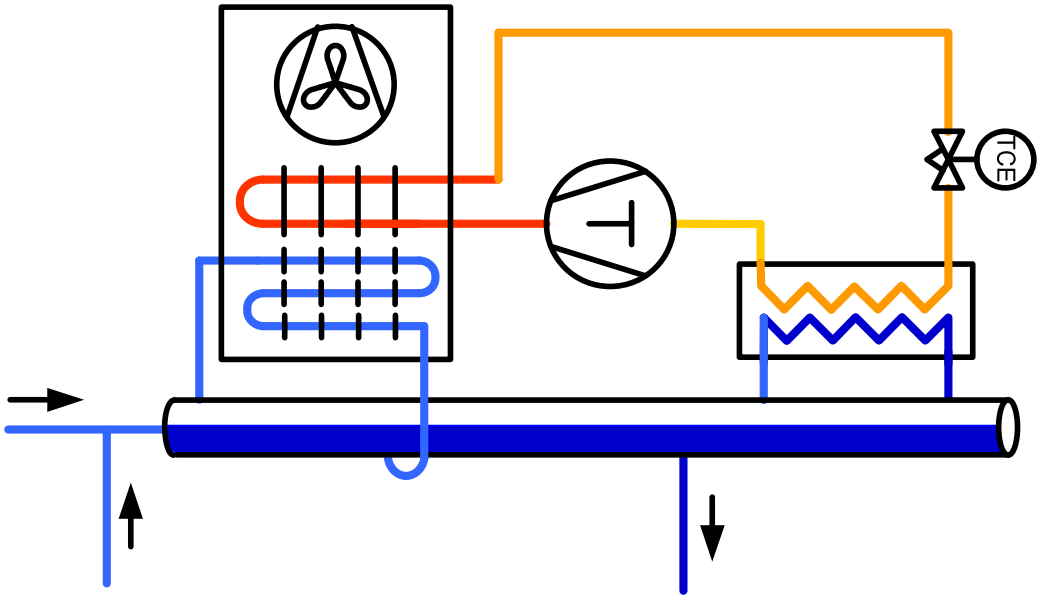
Server room cooling modes

- Medium ambient temperature
- Free cooling and compressors both active



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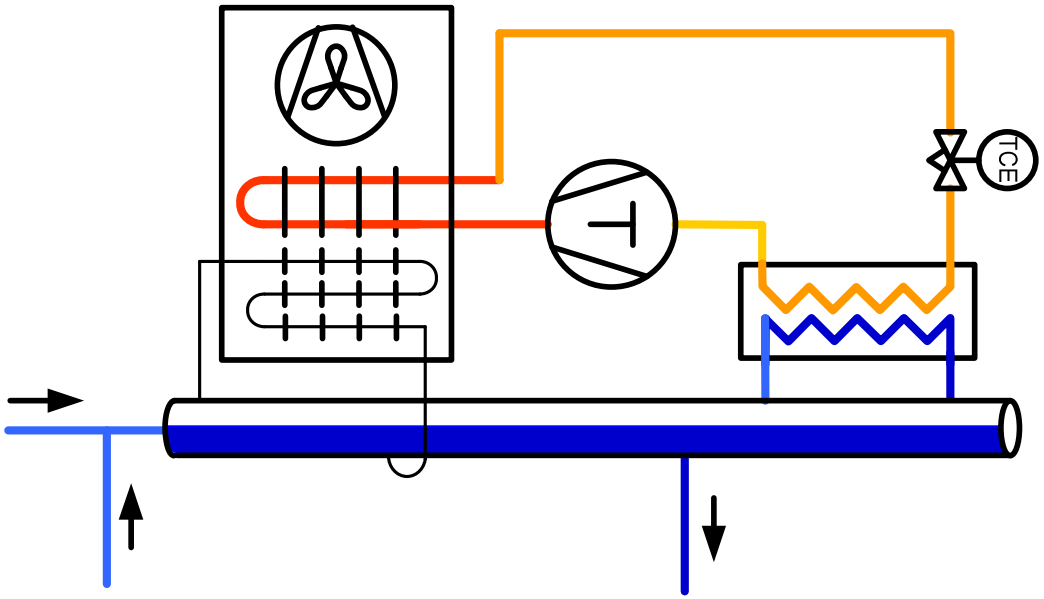
Server room cooling modes

- At high ambient temperatures only compressors are active



System integration

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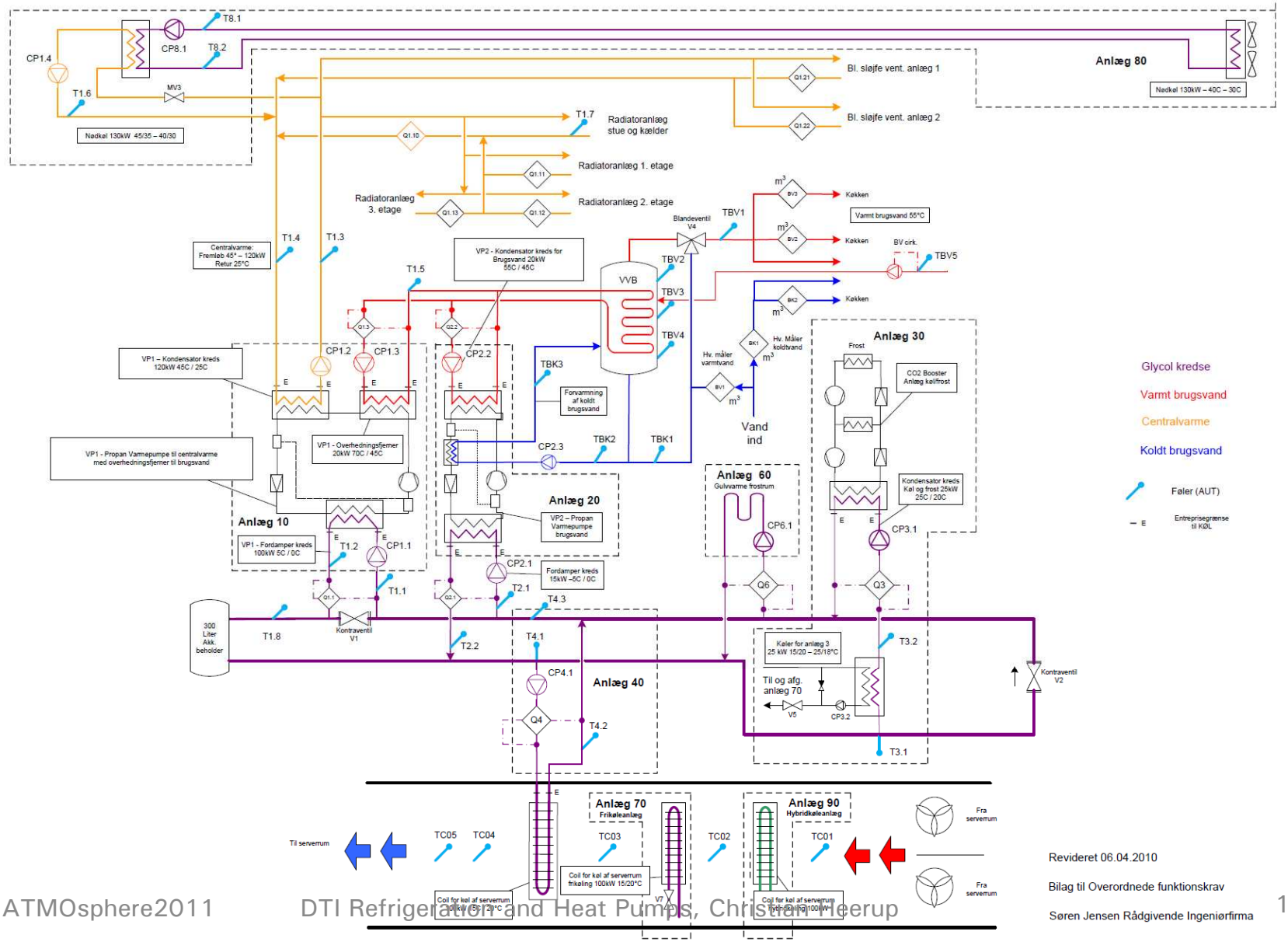

Revideret 06.04.2010

Bilag til Overordnede funktionskrav

Søren Jensen Rådgivende Ingeniørfirma

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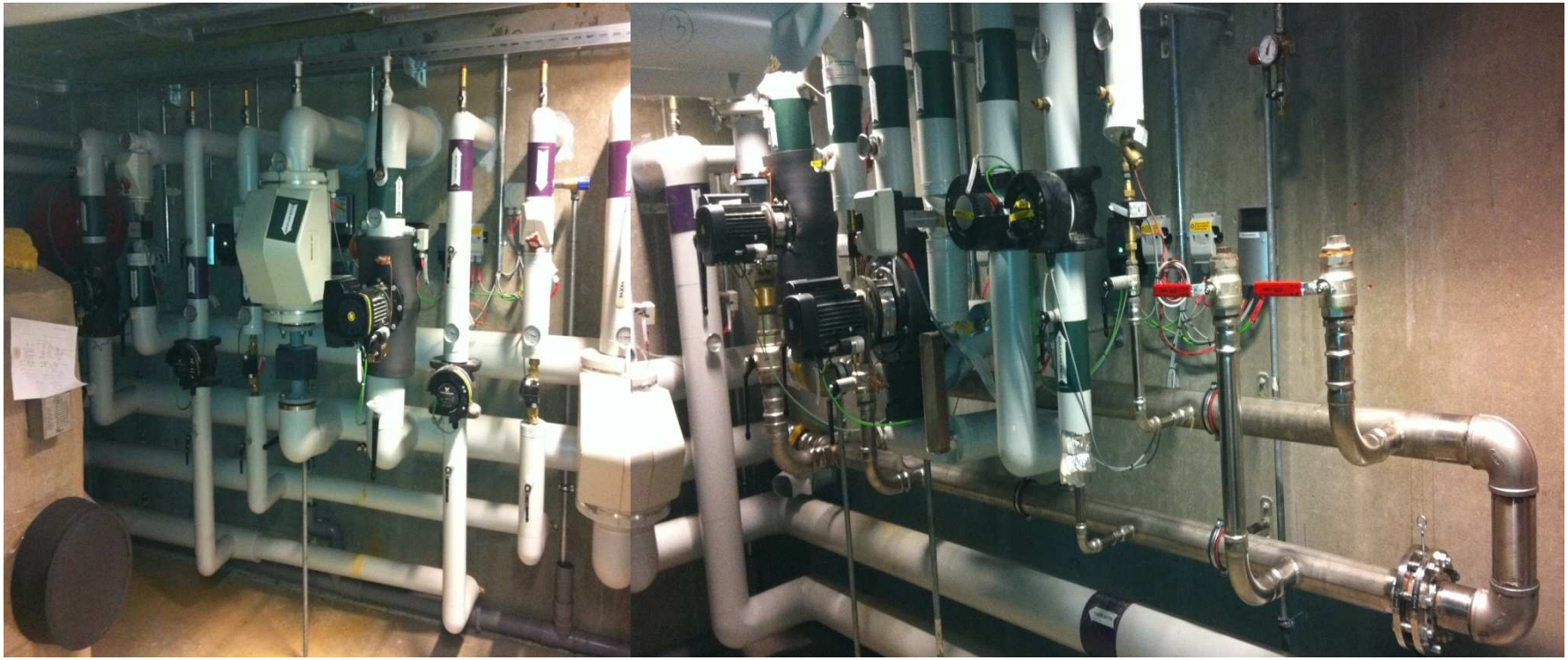
Heat recovery loop



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Heat pumps

Kitchen refrigeration system

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Server room racks and ducts

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CO_2 free cooling unit

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Challenges

- Complexity in commissioning
- Balancing load/ need
- Pump failures in CO_2 system due to wrong setting of minimum speed

Benefits

- Low operation costs
- Long term solution
- Minimised Carbon Footprint

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What is the cost?

- Natural refrigerants
- Heat recovery
- Free cooling

All has been accomplished with a minimum internal interest rate of 8 %

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Good interest rate in spite of

- Installations are 50 % more expensive than cheapest HFC solution (not equivalent)
- Installations are 20 % more expensive than best HFC alternative (but not a match)
- Due to
  - Larger heat exchangers and EC fans
  - Increased free cooling potential
  - Advanced controls
  - Integration of systems
  - Natural refrigerants

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Important factors

- Integration of heating and cooling needs
- Involvement at an early stage of the building planning process
- End-user focus at total operation costs especially energy consumption

How do we improve?