FROM STEAM TO 4GDH IN DK AND US

EXPERIENCE IN DK AND US

Anders Dyrelund, Senior Market Manager, Ramboll Energy
Daniel Kelley, General Manager of US Energy Operations, Ramboll Energy

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OVERVIEW

BENEFITS OF HOT WATER VS STEAM

TRANSITION TOWARDS 4TH GEN. DISTRICT HEATING

STEAM TO HOT WATER

HOW TO LOWER TEMPERATURES IN HVAC AND DH SYSTEMS

SMART PIPE CONSTRUCTION

THREE NORTH AMERICAN CASES

PROBLEMS TO BE SOLVED

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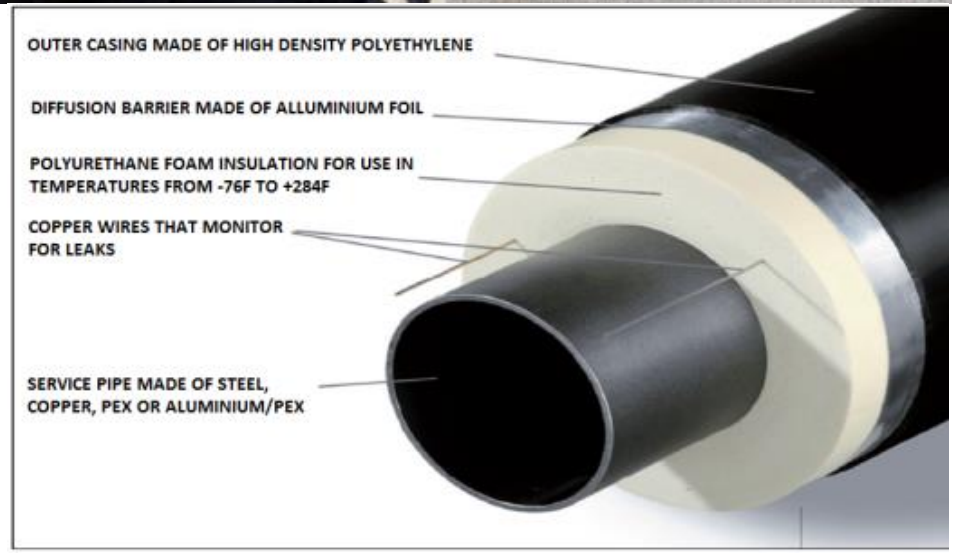
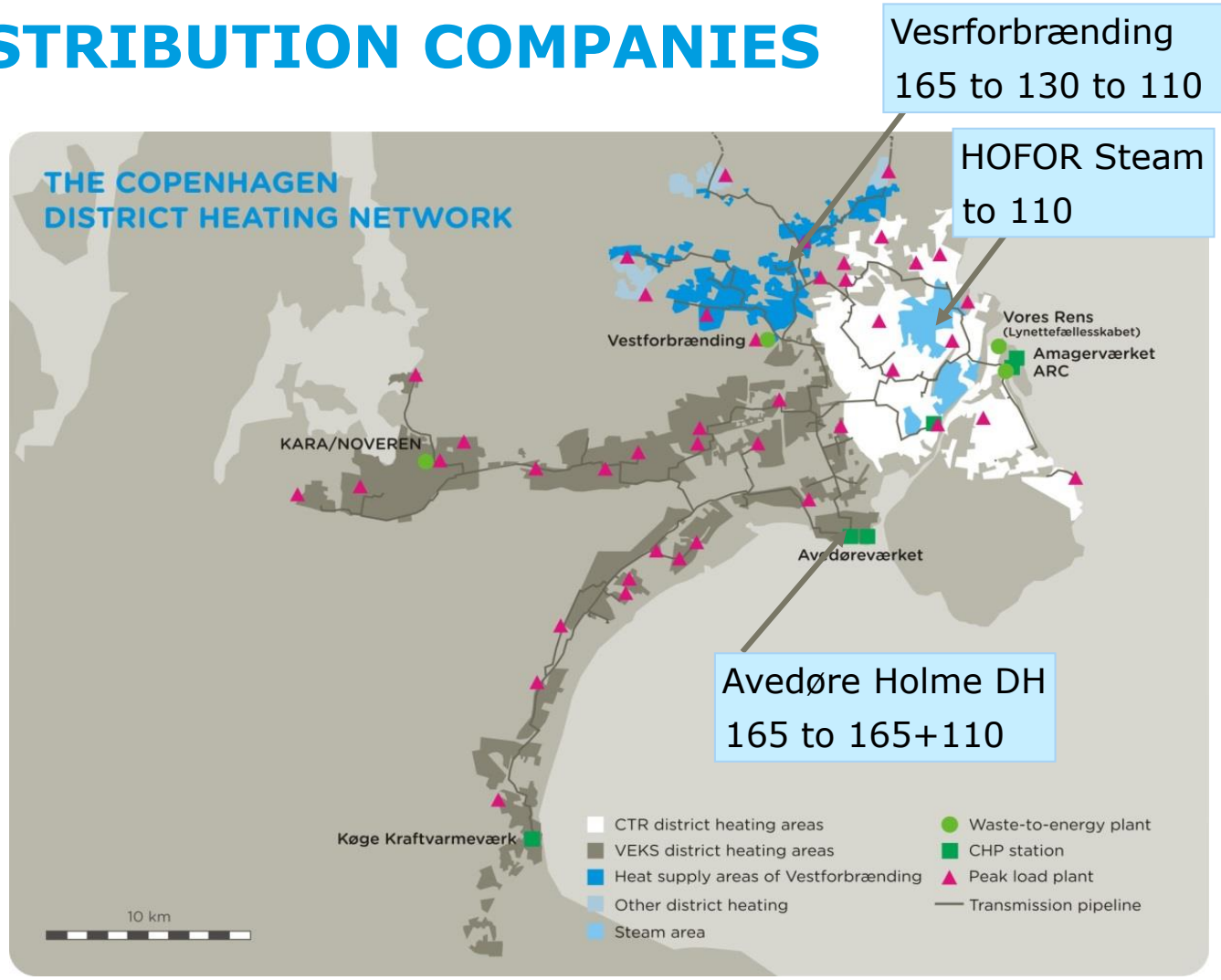
BENEFITS OF HOT WATER VS. STEAM SYSTEM

- ✓ Lower investment costs
- ✓ Lower operating costs due to lower temperatures
  - ✓ higher efficiency for the entire system
  - ✓ lower heat loss 5-10 % vs. 30-50% for steam
- ✓ Significantly lower maintenance costs
  - ✓ no steam traps, condensate return etc.
  - ✓ Minimum of start-up costs
- ✓ High resilience
- ✓ Lower temperatures enable access to a broad range of renewable sources
- ✓ Enables thermal storage to be utilised



TRANSITION TO 4GDH IN GREATER COPENHAGEN
4 TRANSMISSION AND 20 DISTRIBUTION COMPANIES

- HOFOR steam in the city centre:
  - No new steam pipes since 1980 -
  - Local steam heat exchangers basis for supply of new hot water networks 1980-
  - Replacement project from 2009 to 2022
- Vestforbrænding, northern suburbs
  - 165 dgr.C super heated water in 1975
  - Only hot water pipes since 1980 -
  - Max supply from 165 °C to 130 °C in 2000
  - Further to max 110 °C up to 2030 ?
- All distribution companies go for
  - max <95 °C on the coldest day
  - Normal operation 60-80 °C



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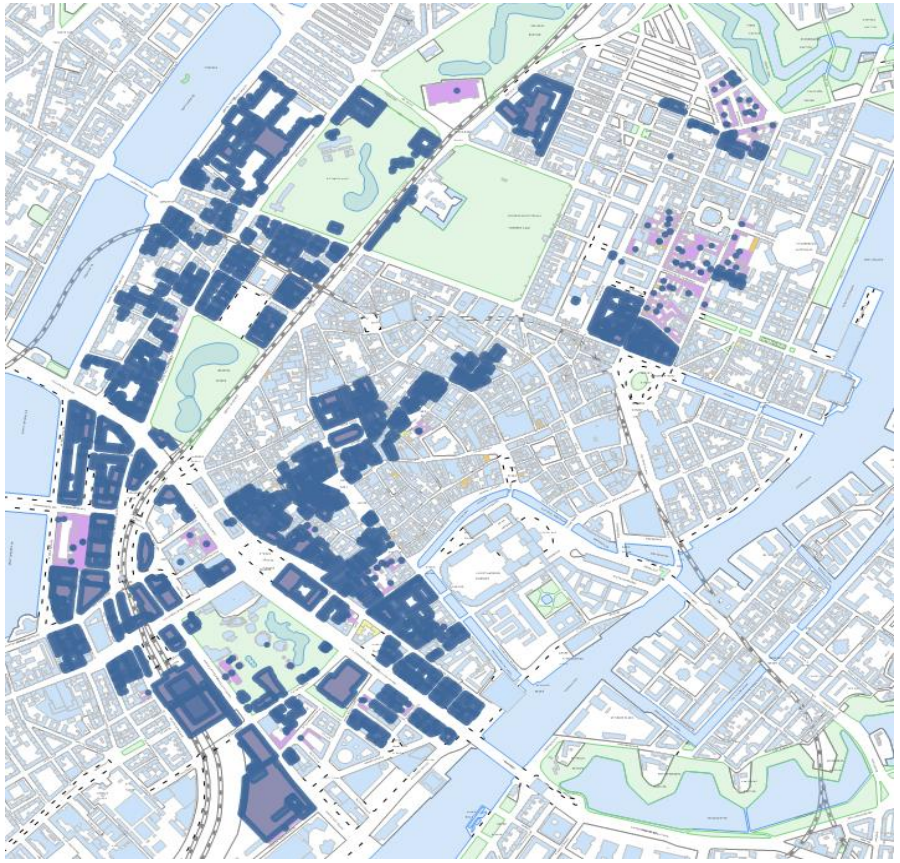
STEAM TO HOT WATER
THE OVERALL PLANNING IN COPENHAGEN

- Planning 2-5 years ahead, heat supply planning
- Internal coordination (joint work between utilities..)
- Dialogue with the authorities (municipal approval)
- Contact to customers and stakeholders (building owners)
- Overall district heat network design – hydraulics
  Working package – Summary of all collected information
- Detailed district heat network design – Pipe dimensions
  Project planning (municipal permits, traffic planning)
- Customers heat exchanger system design
- Establishing the district heating network, Archaeology, traffic, parking, polluted ground, shielding for safety, shops, traders, working progress, etc.
- Restoration of the streets – dialogue with road authority



Source: Rene Thiemke HOFOR

STEAM TO HOT WATER IMPORTANT STEPS

- Establish local District Heating Pipelines
- Rebuild Customer Facilities (steam to water)
- Install a temporary Steam/Water Heat Exchanger
- Switch Customers Supply from Steam to Water
- Expand the main District Heating System and connect to the Local supply Pipelines
- Disconnect Steam Supply Pipelines
- Reuse large double steam pipes to hot water S/R
- Reuse pipes or trench whenever feasible
- Co-ordinate with the district cooling
  - marketing as early as possible
  - construction work in same trench

Source: Rene Thiemke HOFOR

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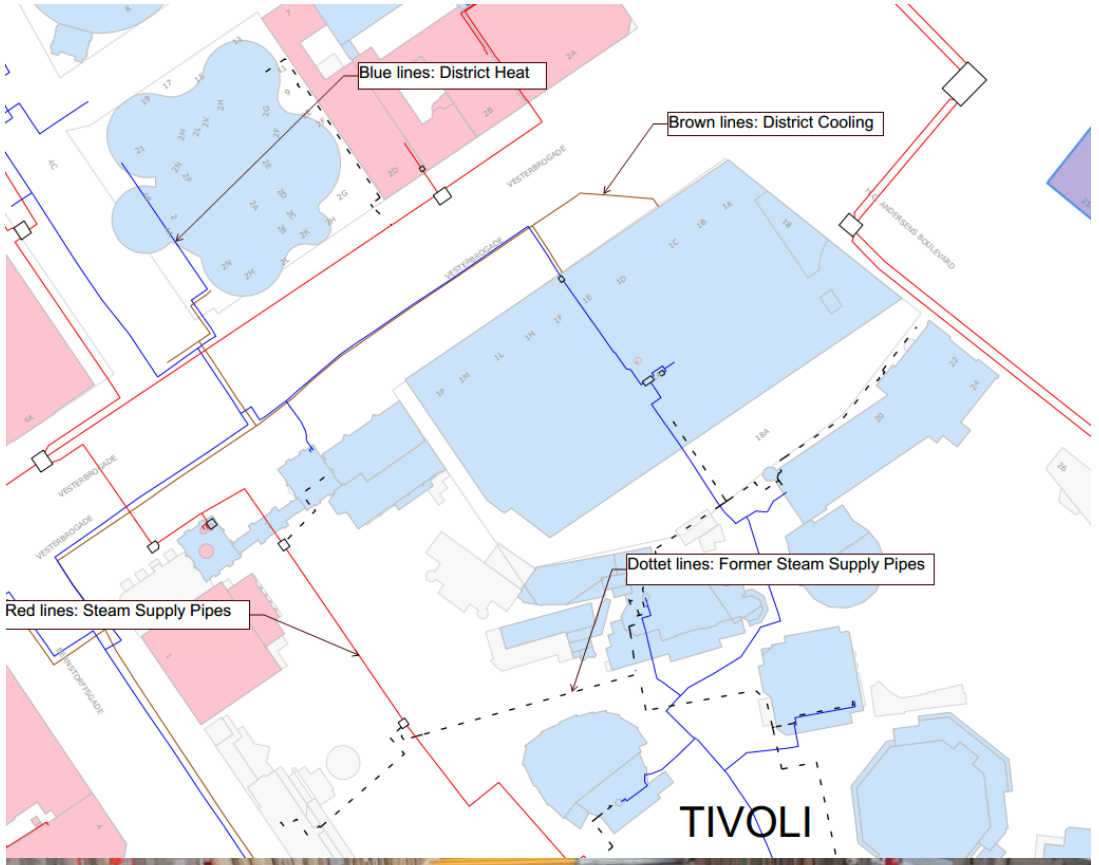
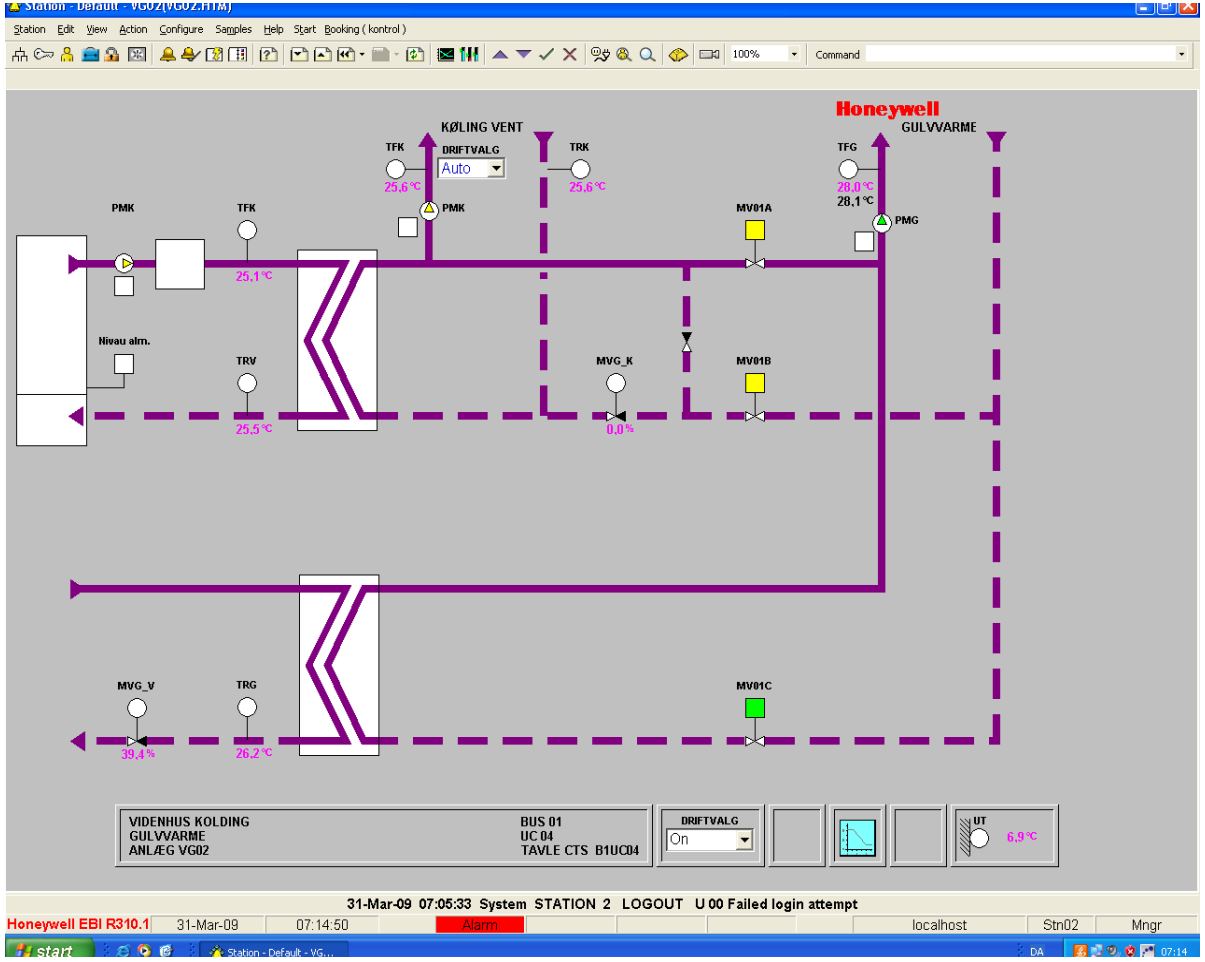


HOW TO LOWER TEMPERATURES IN HVAC AND DH SYSTEMS

- Co-operate with building owners on how to improve HVAC installations
  - Two string systems with thermostats
  - Under floor heating, larger radiators, etc.
- Discount for lower return temperature
- Lower operation temperature, identify critical consumers and find solutions
  - Temperature boost with a boiler
  - 3-pipe connection of critical consumers
- Develop low-temperature zones
  - Supply with low temperature production
  - **3-pipe connection** of low-temp. Consumer
- Optimize the supply temperature



THREE NORTH AMERICAN CASES

GENERAL PROBLEMS TO BE SOLVED

SHERITON COLLEGE IN CANADA

From steam to
Hot water district heating

- Preinsulated pipes
- Twin pipes
- Fixed without expansion joints


CASE


Sheridan

DARTMOUTH COLLEGE, HANOVER NH

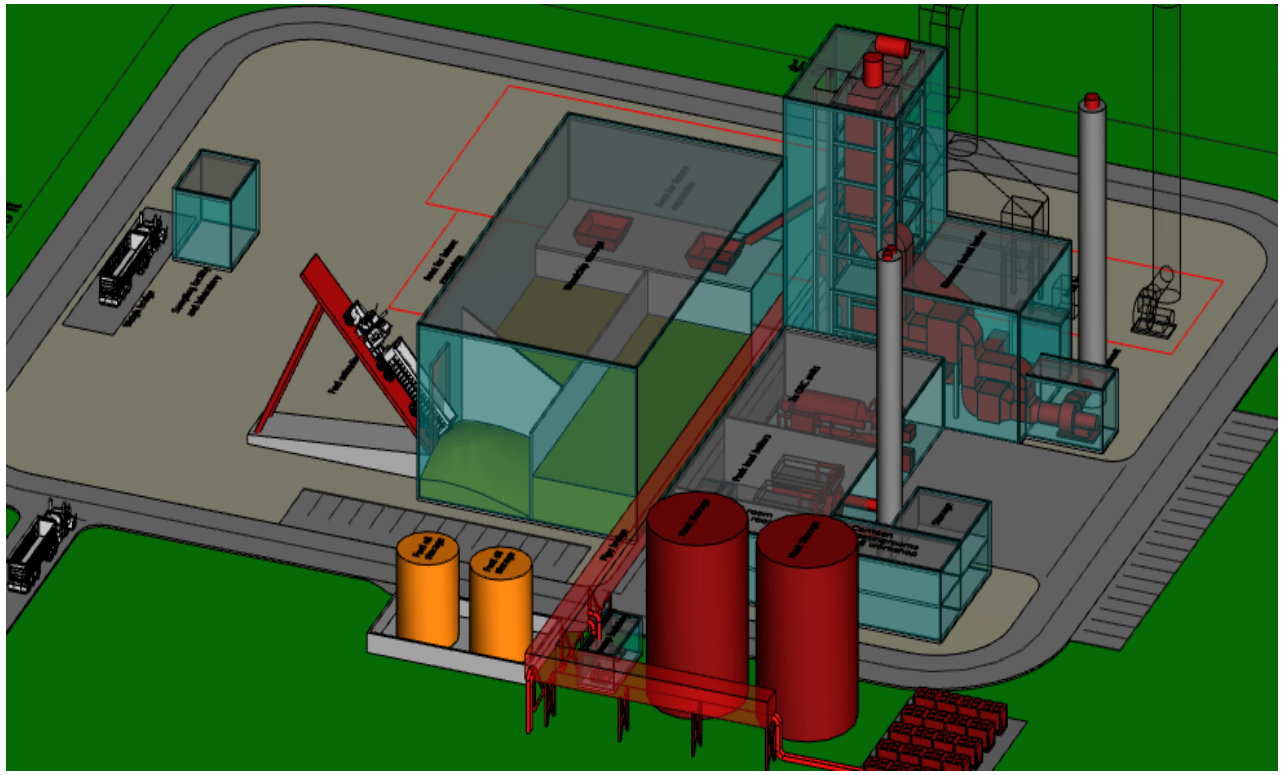
What we did

- Feasibility Studies with variety of production options incl. combined heating / cooling / seasonal storage
- Conversion of steam based DH System. Layout of district heating piping network
- Hydraulic calculations (heating and cooling)
- Energy Plant lay-out and 3D
- Fuel and fuel supply systems
- Detailed strategy for district cooling and chillers

DARTMOUTH COLLEGE, HANOVER NH

What we did

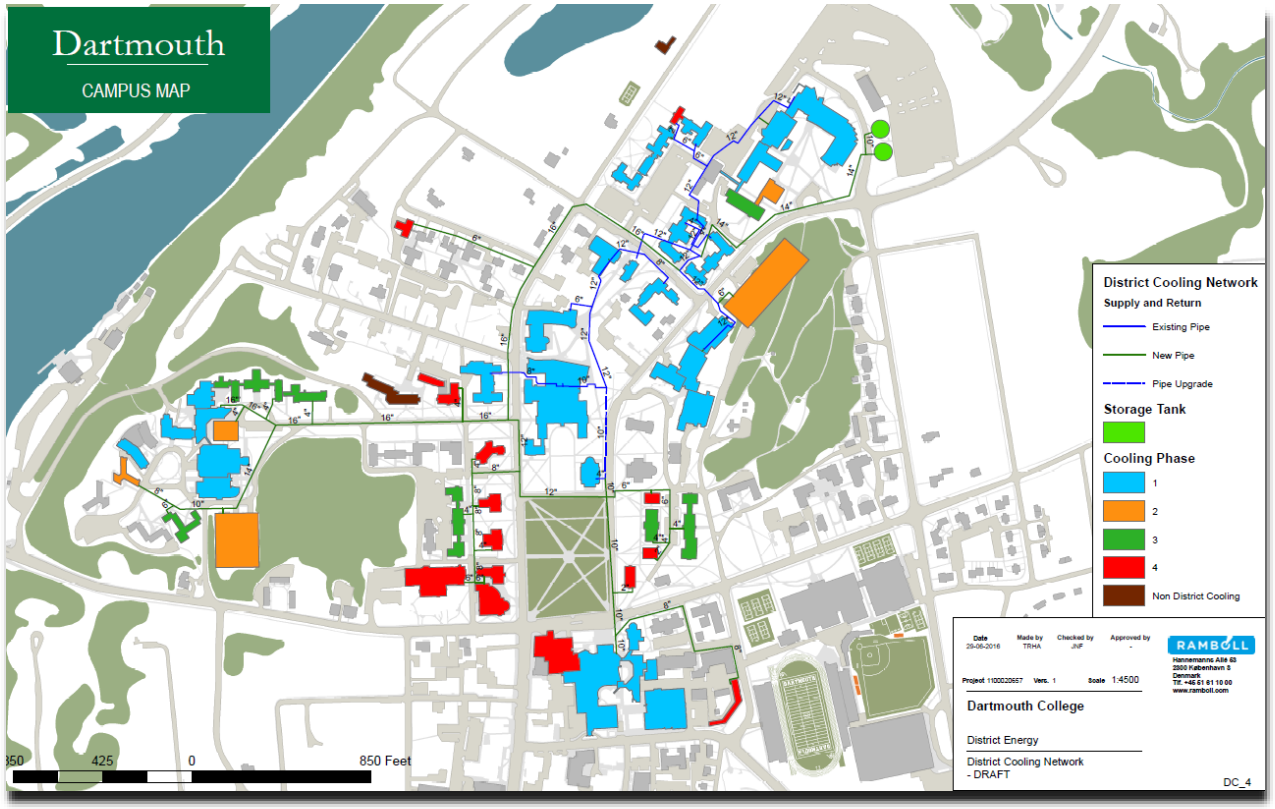
- Utilization of excess energy from cooling production
- Different storage options (PTES, BTES, ATES)
- Boiler sizing strategy
- Close contact with potential vendors (boiler and Organic Rankine Cycle units)
- Electric / SCADA
- Procurement strategy



DARTMOUTH COLLEGE, HANOVER NH

Benefits for the client

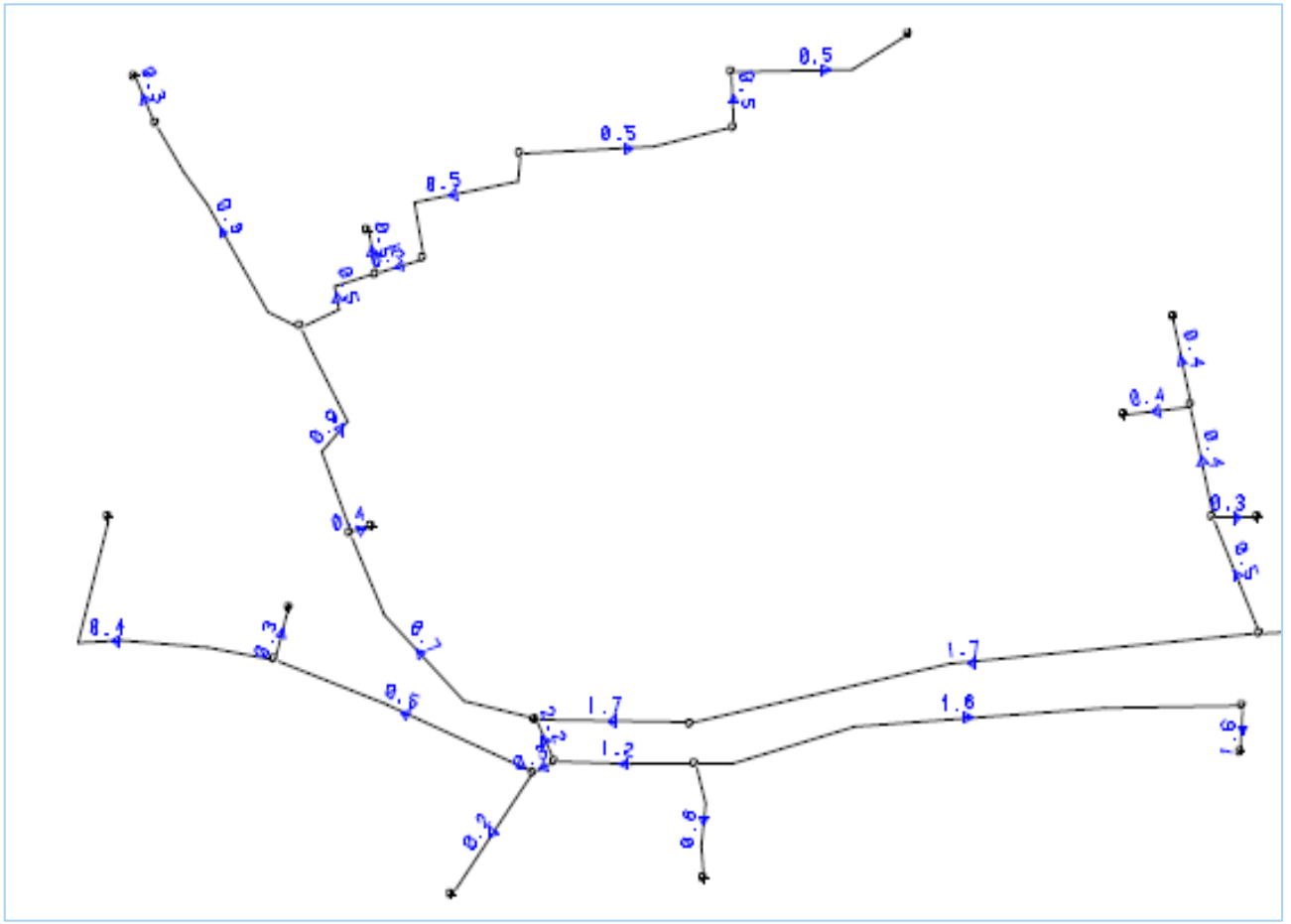
- Reduced dependency on fossil fuels
- A flexible and resilient energy system
- A system prepared for future recovering waste heat from cooling production
- Significantly efficiency increase
- Technical and economic overview of wide range of sustainable options
- Long term planning of district cooling expansion on the campus area



WESLEYAN UNIVERSITY, MIDDLETOWN CT

Conclusion

- Payback time for implementing a hot water loop less than 10 years
- Reduced fuel consumption/carbon emissions due to reduced energy looses
- Great potential for utilizing waste heat from a nearby power plant w. up to 300 MW available waste heat



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NORTH AMERICAN PROJECT EXPERIENCE IN GENERAL

- North American contractors tend to price the implementation of new hot water systems way too high
  - Limited experience and thereby high contingencies
- Project risk and contingencies should not be on the contractor only
- By a close dialog with the contractors and sharing the experiences from Europe the prices can be reduced 30 -50%
- Challenge that firms with European knowledge and experience is not approved for working for government sites like defense facilities

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THANK YOU FOR YOUR ATTENTION
QUESTIONS & ANSWERS

AD@RAMBOLL.COM
+45 51 61 87 66
HTTPS://STATEOFGREEN.COM/EN/PROFILES/RAMBOLL

DKELLEY@RAMBOLL.COM
+1 (207) 517-8258

WWW.RAMBOLL.COM