FROM STEAM TO 4GDH IN DK AND US

EXPERIENCE IN DK AND US

Anders Dyrelund, Senior Market Manager, Ramboll Energy
BENEFITS: 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 center:**
  - No new steam pipes since 1980
  - Local steam heat exchangers basis for supply of new hot water networks
  - 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 in 2030?

- **All distribution companies go for**
  - max <95 °C on the coldest day
  - Normal operation 60-80 °C
STEAM TO HOT WATER
THE OVERALL PLANNING

- 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
HOW TO LOWER TEMPERATURES IN DH SYSTEMS

- Co-operate with building owners on how to improve HVAC installations
  - Two string systems with thermostats
  - Underfloor 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. Consumers
- 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
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
Conclusion

- Payback time for implementing a hot water loop less than 10 years
- Reduced fuel consumption/carbon emissions due to reduced energy losses
- Great potential for utilizing waste heat from a nearby power plant w. up to 300 MW available waste heat
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
THANK YOU FOR YOUR ATTENTION
QUESTIONS & ANSWERS

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