The right pre-insulated pipe systems for large scale solar district heating networks
The LOGSTOR Group & global presence

Headquarters in Denmark
1,500 employees
Annual turnover > 250 MEUR
Owner: Triton Fund III

- 8 plants in Europe, 1 in Asia, 2 mobile production units
- 14 sales units
- Joint ventures in China and Dubai
- Distributors in more than 30 countries
- More than 6,000 km pre-insulated pipes every year
- More than 185,000 km LOGSTOR pipe supplied to date
Large scale solar heating networks
Large scale solar heating networks

- Large scale solar heating networks are already today playing an important role in Denmark
- This is expected to spread to Europe in the future
- This presentation is not about research and development of a new system
- It is about learning from the history when moving ahead
Experience with solar heating networks

• More than 20 years of experience with large scale solar district heating networks

• The first designs was based on the know how from traditional district heating projects
  • Products
  • Design of the system

• The design assumptions were insufficient in respect to
  • Temperature
  • Temperature cycles during service life

Number of temperature cycles in a solar network is up till 40 times more than in a conventional district heating system
Experience with solar heating networks

- Energy companies have experienced damages like
  - Leaking joints
    - Resulting in corroding steel
  - Fatigue failure on the steel
  - Immediate leak that will spread in the pre insulated system
  - Corroding valve connections at the introduction to the solar panels

Wrong design assumptions have lead to damages in the network.
Learning from the experience

- We have today much better understanding of the design criteria's
  - Temperature in the system over the year
  - Number of temperature cycles over service life
- The right products that will withstand the loads from the temperature cycles

The expensive experience has lead to better knowledge and better design assumption
Design criteria, Temperature cycles over service life

- **Standard district heating system**
  - The system is designed for a minimum service life of 30 years with the number of full temperature cycles depending on type of network
  - Transmission pipelines: 100 temperature cycles
  - Distribution pipelines: 250 temperature cycles
  - House connections: 1000 temperature cycles

- **Large scale solar district heating system**
  - Number of full temperature cycles over 30 years is 3500 – 10950
  - Depending on the system

A full temperature cycle

1 is time
2 is the full temperature cycle

**Crucial to work with the right design parameters**
Example on design with different design parameters

- **Standard district heating system**
  - Max. temperature 110 °C
  - 250 full temperature cycles over service life

- **Solar district heating system, type 1**
  - Max. temperature 110 °C
  - 3500 full temperature cycles over service life

- **Solar district heating system, type 2**
  - Temperature between 10 – 110 °C
  - 1 full temperature cycle per day
  - Shortly up till 150 °C 5 hours twice a year
  - Full temperature cycles over service life is 10950

- **General assumptions**
  - Installation temperature 10°C
  - Soil cover 0,6 m
  - Pressure 6 bar

**Comparison of 3 different design criteria's**
During winter time temperature in the pipe system can go down to -15 °C
Example on design with different design parameters

- Elbow loaded 50%
  - District heating
  - 250 temperature cycles

- Elbow fully loaded
  - Solar heating
  - 3500 temperature cycles

- Elbow fully loaded
  - Solar heating
  - 10950 temperature cycles
Empty conductor pipe arround the standpipe
Standpipe placed centric at the time of installation

Movement must be calculated at peak temperature
During winter time temperature in the pipe system can go down to -15 °C
Component requirements

- Welded joints is recommended
- All standpipes to the solar panels must be placed in empty conductor pipes
- Branches and bends must be pre-insulated
- It is recommended that change in direction is done with 90° bends
- No twin pipes when number of temperature cycles is more than in a normal district heating network
- Active Monitoring system

The right components are essential for a long life time
Component requirements

- Standpipes designed for the specific project
- Match the exact position of the solar panels
- Indoor manufacturing
- By companies specialized for this work
- Secures optimum conditions for high quality

Standpipes prepared indoor at factory site is an opportunity
Design requirements

- A detailed static calculation must be done on all bends based on the number of full load temperature cycles
- The maximum pipe length section is calculated based on the “free space” in the empty conductor pipe around the standpipes
- During winter time temperature in the pipe system can go down to -10 °C till -20 °C
- Use foam pads at change of directions
- These design requirements apply in the network between the solar panels and the heat exchanger before the standard district heating network

Static calculations based on number of temperature cycles
Focus on total cost of ownership (TCO)

- Essential for a long life time is the right choice of products and the right system design.
- Essential for the lowest TCO is the balance between the investment in pipe system and installation and the heat loss of the system over life time.
- Lowest heat loss is achieved on systems with axial conti pipes with a diffusion barrier and low lambda value.
- The diffusion barrier will secure the low heat loss in the entire life time.
Focus on total cost of ownership (TCO)
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3rd international conference on Smart Energy Systems and 4GDH

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12 September 2017