Heat Networks: Planning for a Zero-Carbon World

UK Local Authority District Energy Vanguards Network

Sheffield, 10 March 2020
District Energy Vanguards Network

Stay in touch:
Michael King - michael.jking@blueyonder.co.uk
Liz Warren - liz.warren@se-2.co.uk

https://heatandthecity.org.uk/
Peter Russett
FVB
FVB District Energy UK Ltd
The Complete Energy Consultancy
HEATING – COOLING – HEAT PUMPS – CHP – PROCESS – THERMAL STORAGE
Introducing FVB

• **FVB UK is an Anglo-Swedish Planning, Engineering and Management Consultancy.**

• **50 years of Industry Experience Providing Real World Solutions**

• **Combination of Business and Technical Skills Focused on District Heating & Cooling Networks and Specialising in:**
  
  • Techno-Economic Support During the Full Project Lifecycle
  • Heating & Cooling District Networks
  • Energy Productions sources
  • Thermal storage
  • Process systems
Future-proofing of District Heating

Energy Trilemma
- Carbon Emissions
- Security of Supply
- Energy Costs

District Heating is an energy delivery system

A heat network can be used by multiple heat sources, including low carbon and waste heat to reduce CO2 emissions and provide reliable supply. Heat networks can deliver heat at a cost comparable to individual gas boilers and at a lower cost than electric heating.
Adaptable District Heating

Key future proofing District Heating principles:

• A high grade heat source can supply a low grade heat network, but not vice versa.
  • Reducing operating flow and return temperatures. Current 4th generation DH systems can achieve 60-65°C flow and 30-35°C return temperatures.
  • This enables the use of low grade and low carbon heat sources – Heat Pumps and waste heat.

• A low grade/low pressure heat source can use a heat network infrastructure rated for high grade/high pressure heat, but not vice versa.
  • Install main carrier pipes that are rated for higher temperature or pressure to allow for DH networks link, capacity increase and connection to a different heat source in the future.
The District Heating System

- District Heating Network is to connect over 130 buildings within Stoke on Trent, connecting Stoke Town, Staffordshire University, Stoke College, Etruria and Hanley areas.
- Total design heat production is approx. 48GWh/year mainly produced by Energy from waste and Geothermal plant.

FVB Scope

FVB with their strategic partner, Natural Power, are the Mechanical & Electrical Design specialists for the DHN scheme, supporting the SoT Council with design services across the installation of all aspects of the project including:

- Heat Distribution Network
- Energy Centres
- Local Connections and Heat Substations
- Future Decarbonisation

Role includes review of potential heat sources and heat production to reduce carbon reliance for the initial and ongoing scheme expansion.
Achieving Zero Carbon

Västerås – *A Swedish Example*

- Population of approx. 150,000
- Second city in Sweden to have a DH scheme
- DH scheme commenced in 1954
- 98% of heat supplied by DH scheme, 1800GWh/year with a peak load of 600 MW
- 31MW cooling network – mainly through free-cooling from Lake Mälaren
- 34GWh/year electrical energy production

In 2018 Västerås became carbon neutral in its supply of heat.

- Heating plant utilises:
  - Energy From Waste Plant
  - Biomass
  - Heat Pumps
  - Thermal storage capacity of 49,000,000 litres
Achieving Zero Carbon

Västerås – A Swedish Example

The Fuel Timeline

1960 - Oil 1963
1970
1980 - Coal 1981
1990 - Bio 2000
2000 - Peat 2002
2010 - MSW + Biomass 2014
2020 - MSW + Sorted Waste + Waste Wood + Biomass
Achieving Zero Carbon
Västerås – A Swedish Example

Coal & Oil Use for Heat Production in Västerås
Case Studies

Stockholm

The District Heating System:

• Systems cover 85% of the heat market within the City of Stockholm.
• Total heat production is circa 10TWh/year mainly produced in large heat pumps and CHP Plants, mainly supplied by heat from Waste and biomass.
• Approx. 14,000 c are supplied through a pipeline network of approx. 900 km.

The District Cooling System:

• One of the largest district cooling networks in the world. Approx. 600 customers are supplied through a network of 150 km.
• Total cooling production is about 0.4 TWh/year, produced with heat pumps, chillers, free cooling and aquifers.

Contribution

FVB has provided consultancy services since the late 1970’s. FVB undertake projects across the entire system from production plants, distribution networks and customer.
Our tasks cover everything from feasibility studies, through detail design, tender documents, evaluations to supervision during construction and commissioning.
Global Presence – Local Solutions

FVB has over two hundred District Energy focused employees world-wide; with offices in Sweden, United Kingdom, Canada and the United States of America; FVB has consulted in District Energy for 50 years, working in over 30 countries.

HEATING – COOLING – HEAT PUMPS – CHP – PROCESS – THERMAL STORAGE

FVB are bringing the best in class Scandinavian experience, knowledge and delivery capabilities to the UK market.
Services

Feasibility and Master Planning
- Feasibility Studies
- Energy modelling
- Master Planning, Energy Mapping
- Energy and Environmental Policy
- Marketing and Sales consulting

DH Network Adoption Support
- Design Due-Diligence
- Owners Engineer
- Commissioning and Operational Support
- Performance Assurance
- Financial Modelling & Business Assessment

Site Operation Support
- Scheme Optimisation
- LTHW Conversion and modification
- Operating network Hydraulic Analysis and Modelling
- Network Extensions

Design & Engineering
- Design from Feasibility to Construction
- 3D Design
- Specification & Tender Documentation
- Control Strategies
- Detailed pipework and route appraisal
- Network Hydraulic [Netsim] and Buried Pipeline Stress Analysis [Rohr2]
- CDM Compliance
- BIM Design
Areas of Operation

- District Heating and Cooling Networks
- Heat Pumps
- Low Carbon Networks
- Ambient Loops
- Energy Centres
- Thermal Storage
- Combined Heat & Power
- Energy from Waste
- Industrial Waste Heat
- Boiler Plant
- Solar Thermal
- Deep Water Cooling
- Gas Peaking Plant
- Steam System Design
Key Contact Details

Peter Russett
General Manager
M: +44(0) 7545 074 466
T: +44(0) 118 206 2920
peter.russett@fvb.uk.com

Valeria Khnykina
Senior Consultant
M: +44(0) 7545 074 477
T: +44(0) 118 206 2919
valeria.khynkina@fvb.uk.com

Ola Nordgren
Managing Director, FVB UK
M: +44(0) 787 205 54 53
T: +46(0) 21-81 80 65
ola.nordgren@fvb.uk.com

FVB District Energy UK Ltd
9 Greyfriars Road
Reading
Berkshire, RG1 1NU
Andy Yuill
Natural Power
Planning for Low Carbon Heat

Vanguards – Sheffield 2020

Date: 10th March 2020
Produced By: Andy Yuill
Senior Renewable Heat Manager
andyy@naturalpower.com
07920 335 012

Produced For: Vanguards
Our services

Renewable Heat

- Heat networks
- Biomass
- Energy from Waste
- Heat pumps
- Anaerobic digestion
- Geothermal
“Low carbon and low cost = 4th Generation district heating”
4th Generation is actually very difficult.

(but not impossible!)
Designing for heat networks

Demand – Volume + Profile

Future developments

Capacity
Required Data

Heat Demand
- Half Hourly Metered = ☺
- Estimated from Benchmarks = 

Heat Profile
- Extracted from BMS = ☺
- Estimated from Best Practice = 

Secondary Side
- Tested and Validated = ☺
- Estimated from Site Visit = 
Roadmap to implementation

**Heating Season 2020/21: Analysis**
- Analyse building demand
- Assess current heat provision
- Implement monitoring and collate data

**Heating Season 2021/22: Implement and test**
- Heat demand data reviewed
- System changes implemented
- Test changes and monitor performance

**Heating Season 2022/23: Build**
- Design and build heat network
- Connect buildings to heat network
- Year one of heat network operations
Roadmap to implementation
Andy Yuill
andyy@naturalpower.com
07920 335 012
Ian Allan
Switch2
Switch2 Energy

Making a success of heat networks
Over 35 years’ experience

- 280,000 bills sent annually
- Serving 80,000 customers
- Processing £26 million in payments
- 500 schemes
- 105 energy centres
- 35,000 PAYG customers
- 40 engineers
- 164 employees
- 164 employees
The challenges:

- Lack of knowledge
- Poorly operated schemes
- Debt exposure
- Vulnerable residents
- Customer perception and satisfaction

Adapting to regulation:

- Reliable heat
- Affordable heat
- Comfort & convenience
Communal heating Vs district heating: The difference

An example district heating scheme
Communal heating Vs district heating: The difference

An example of a communal heating scheme
DIGITAL REVOLUTION
BRINGING REAL SAVINGS TO HEAT NETWORKS

- Reduction in planned and reactive maintenance
- Improved efficiency of heating system
- Combats fuel poverty
- Reduced primary energy costs
- Abolish critical events

optimise

CARBON SAVINGS
Heat networks in a digital world
The role of metering in delivering reliable low cost networks

- Operations
- Meters the eyes and ears of your network
- Return temps
- Quality of heat
- Proactive maintenance
- 5G and NB IoT
Private wire on heat networks
Thank you
Paul Atkinson
Logstor
Reducing Whole Life Costs Using Leak Detection

Paul Atkinson
Technical Sales Engineer

paatk@logstor.com
+447787 069678
District Heating System Monitoring

Supply Side – CHP, EfW, etc

Demand Side

Distribution Network
Passive v Active Monitoring

**Passive** – Dipstick

**Active** – Oil warning light
Passive v Active Monitoring
Passive Leak Detection System

Leak Detection Wires …

Monitoring Device…

Surveillance System

Aarhus Case Study

One manual measurement each year

Failures only showed when manual measurement made

1 failure in every 240 m trench
Failure Types

- Casing damage
- Poor Installation
- Fatigue Fracture
- 3rd Party Damage
- Beyond Service Life
- Expansion
Active Leak Detection System

Leak Detection Wires …

Monitoring Device…

Surveillance System
Full Digitised Detection System
Benefits

- Defects show in first 6 – 9 months
- Contractors bare cost of repair in defects period
- **Now 100% focus from installers on quality**
- Issues spotted immediately – monitor and react AND pinpoint exactly
- 3rd party damage spotted immediately – cost borne by them
- Maintenance & whole life costs dramatically reduced
- Lifetime of system extended
Why would you not have Active Surveillance??
Paul Atkinson
Technical Sales Engineer

paatk@logstor.com
+447787 069678
District Energy Vanguards Network

Stay in touch:
Michael King - michael.jking@blueyonder.co.uk
Liz Warren - liz.warren@se-2.co.uk

https://heatandthecity.org.uk/
Heat Networks: Planning for a Zero-Carbon World

UK Local Authority District Energy Vanguards Network

Sheffield, 10 March 2020