HEAT ACADEMY ONLINE

Why Heat Networks Work

15th May: 10.00 – 11.30 (UK Time)
AGENDA
Why Heat Networks Work

Topics to be addressed include:

- Why decarbonising heating is a priority?
- How heat networks work, and why you can rely on them?
- Who to connect, and when – becoming “zero-carbon ready”?
- What does it mean to be connected – technically and commercially?
- What are the broader benefits for the community?
EXAMPLES ON CUSTOMERS & PARTNERS

PREPARATION  DECISION  EXECUTION

NORDIC HEAT
Peer-to-Peer Advisory Services – From Vision to Operations

250 PROFESSIONALS FROM 20 MARKETS
HEAT ACADEMY
Training – Innovation – Jobs

Focus Areas

Heat Provision
Cooling Provision
Distribution
Energy from Waste
Connect & Control
Building Efficiency
Operations
Mine Heat

Vocational Training
With local universities and colleges

Professional Training
>5,000 participants

Apprenticeships
Exchange programmes

Innovation
Collaborative innovation initiatives

Countries:
- Canada
- US
- China
- India
- UAE
# Key Processes

## Political Vision
- Objectives & strategy
- Market Research
- Strategic Plan
- Techno-Economic Model
- Techno-Economic Model

## Commercial Pre-Design
- Prel. Business Case
- Heat Mapping
- Risk Analysis
- Operational Modelling
- Benefits mapping
- Replication Cases
- Preliminary Design
- Simulations

## Feasibility
- Objectives & strategy
- Financial market testing
- Business Plan
- Establishment of End USERS
- Secure anchor customers
- Stakeholder mapping
- Admin. strategy

## Technical Pre-Design
- Assign project leader
- Organise Team
- Roles & Responsibilities
- Recruitment and training
- Health & Safety
- Reporting routines
- Technical compliance
- Risk profiling

## Human Competencies & Resources
- Sales management
- Value Proposition
- Final Tariff model
- Contractual arrangements
- Extended offer - efficiency
- Roll-out comm. Plan
- Digital support tools
- Sales training of all staff

## Decision
- Business Plan 2.0
- Executive Summary
- Formal proposal to Board
- Presentation material
- Communication
- Secure Funding
- Secure Legal Framework
- Final Decision

## Technical Final Design
- Heat generation plan
- Distribution System
- Network Route
- Connect & Control
- Energy Efficiency
- Quality Management
- J2 & J2 Re-design
- Finalise detailed design

## Installation Resources & Execution
- Health & Safety
- Local Supply Chain
- Contract Management
- Stakeholder co-ordination
- Quality Systems
- Budget Control
- Documentation
- Independent audits

## Operations
- Contract management
- Customer Management
- Maintenance
- Technical efficiency
- System optimisation
- Benefits benchmarking
- Performance review
- Scheme expansion

## Programme Preparation
- Vision
- B-Plan
- Design
- Sales
- Financing
- Procurement
- Installation
- Commissioning

## Programme Execution
- Operations
- Heat Map & Master Plan
- Soft Market Testing
- Secure heat supply
- Detailed route design
- Review technical solution
- Route feasibility
- Technical compliance
- Collaboration

## Programme
- POLITICAL VISION
- COMMERCIAL
- FINANCIAL/LEGAL
- DECISION
- TECHNICAL
- INSTALLATION
- COMMISSIONING

## FEASIBILITY
- TECHNICAL
- HUMAN
- COMMERCIAL
- PROCUREMENT
- COMMISSIONING

## Training & Manuals
- Training
- Technical audits
- Performance review
- Commissioning strategy
- Health & Safety review
- CAPEX vs. Budget
- OPEX vs. Budget
- Legal documentation
HEAT ACADEMY
Securing Capacity and Quality

THERMAL NETWORKS

25 Million * Pipes

Market Share

2020

2030

(time)

2% - 20%

Peter Anderberg - pa@heatnet.se / +46 70 56 111 99

Market Share

2020

2030

(time)

2% - 20%

25 Million * Pipes
# HEAT ACADEMY

Securing Capacity and Quality

## PRODUCTS & SERVICES

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<tr>
<th>BUSINESS MODELLING</th>
<th>TECHNICAL DESIGN</th>
<th>SIMULATIONS</th>
<th>DECISION MAKING</th>
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<tr>
<td><strong>HEAT GENERATION</strong></td>
<td><strong>DISTRIBUTION</strong></td>
<td><strong>CONNECT &amp; CONTROL</strong></td>
<td><strong>ENERGY EFFICIENCY</strong></td>
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<tr>
<td>HARDWARE (examples)</td>
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<td>Building</td>
<td>Pipes</td>
<td>Insulation systems</td>
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<td>Radiators</td>
<td>Billing systems</td>
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<td>Pipes</td>
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<td>Windows</td>
<td>IoT solutions</td>
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<td>Electrical components</td>
<td>Valves</td>
<td>Monitoring &amp; Control</td>
<td>Integration technologies</td>
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<td>Pollution control</td>
<td>Leak detection system</td>
<td>Digital solutions</td>
<td>Intelligent Heating Pack</td>
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<td>Services (examples)</td>
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<td>Handling of heavy goods</td>
<td>GPR/3D mapping</td>
<td>Installation</td>
<td>Billing Services</td>
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<tr>
<td>Logistics &amp; Stock</td>
<td>Civil Works</td>
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<td>Customer Care services</td>
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<td>Installation</td>
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<td>Logistics &amp; Stock</td>
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<td>Construction/ Civil Works</td>
<td>Leak detection</td>
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## INSTALLATION & O&M

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<tr>
<th>PROGRAMME MANAGEMENT</th>
<th>QUALITY &amp; DOCUMENTATION</th>
<th>HEALTH &amp; SAFETY</th>
<th>O&amp;M</th>
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<tbody>
<tr>
<td>Peter Andersson - <a href="mailto:pa@heatnet.se">pa@heatnet.se</a></td>
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HEAT ACADEMY
Securing Capacity and Quality

COLLABORATIVE MODEL

COLLEGES
UNIVERSITIES
PUBLIC INSTITUTIONS
SUPPLY CHAIN

CANADA
US
CHINA
INDIA
UAE

DURHAM
PERTH
GRIMSBY
STOKE-ON-TRENT
NOTTINGHAM
PORTHSMOUTH
LONDON
BRIDGEND
Decarbonising Heating & Cooling
Rapidly Growing Market

Prospects for Younger Generations

Economic Crisis
Energy Crisis
Social
Prospects
Global Pandemic
Balance-of-Trade
Climate Crisis
Natural Resources
UK HEATING SECTOR - 2019
FOSSIL FUELS

Overview

WHAT’S IN DEMAND

PRIMARY ENERGY

CONSUMPTION

CO₂ EMISSIONS

HEAT 48%

HEAT 35%

ELECTRICITY 13%

TRANSPORT 39%

HEAT 35%

CO₂ EMISSIONS

UK HEATING SECTOR - 2019
FOSSIL FUELS

What’s in Demand

Overview

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Consumption

CO₂ Emissions

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Heat 35%

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Transport 39%
Decarbonize buildings which represent 50% of emissions
OPTIONS & STRATEGIES

Why change unless you have to?
OPTIONS & STRATEGIES
Why change unless you have to?

ORGANIC GROWTH: 1964 - 2019

Customers

50

60 Km

500 000

1964
1971
1975

Helsingborg
Landskrona
Lomma
Malmö
Angelholm
Lund
Eslov

Customers

50

60 Km

500 000
OPTIONS & STRATEGIES
Why change unless you have to?

MARKET SHARE – HEAT NETWORKS

Market Share: 60%
Fossil Fuel: 3%

HEAT SOURCES
OPTIONS & STRATEGIES
Why change unless you have to?

Market Share:
>90%

HEAT SOURCES

STOCKHOLM

(time)

1964 1971 1975 2020
OPTIONS & STRATEGIES
Heat Networks

1964
FOSSIL FUELS >90%

2020
FOSSIL FUELS <10%

Heat Pumps
Industrial Waste Heat
Biogas
Geothermal
Mine Heat
Biomass

Solar Thermal
Energy from Waste
Waste Wood
Sewage Water
OPTIONS & STRATEGIES
Heat Networks - Benefits

1964
Fossil Fuels >90%

Energy Security & BoT

€5Bn annually

1964

2020
Fossil Fuels <10%

Heat Pumps
Industrial Waste
Heat Biogas
Solar Thermal
Energy from Waste
Waste Wood
Sewage Water

Geothermal
Mine Heat
Biomass

Boosting Local Economy

Social Welfare

Local Resilience

Investments

Green Agenda

End User Conveniences

£25Bn annually
OPTIONS & STRATEGIES
Why change unless you have to?

1964  1971  1973

1973
INTERRELATED CRISES

Demand +45%  
Supply +15%  
Shortfall

Energy crisis!

Climate crisis!

2°C
THE BIGGER PICTURE
Converging Crises

THE DEVIL’S ALTERNATIVE

[Images of Greta Thunberg, Trump, and wildfires]
OPTIONS & STRATEGIES

Crises generates opportunities

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Mine Heat
Energy from Waste
Biomass
Waste
Wood
Biogas
Geothermal
Solar Thermal
Heat Pumps
Industrial
Waste Heat

Sewage Water

Heat Pumps

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Energy from Waste

Waste
Wood

Biogas

Geothermal

Mine Heat

Biomass

Sewage Water
OPTIONS & STRATEGIES
Why change unless you have to?
OPTIONS & STRATEGIES

Net Zero Ready

1964
1971
1975
2012

Net Zero Ready 1
Net Zero Ready 2
Net Zero DONE!

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OPTIONS & STRATEGIES
Why change unless you have to?

Organic Growth: 1964 - 2019

Customers

1964
1971
1975

50
500 000
60 Km

50

Helsingborg
Ängelholm
Lund
Köv
Lomma
Malmö
Vesvik
Landskrona

Customers

60 Km

500 000
AFFORDABLE HEATING
SBRI – Innovation Initiatives

PRIORITISED INNOVATION AREAS

TECHNICAL DESIGN
Rightsizing & Standardising
Digital solutions, e.g. simulations
Collaboration & Replication

PROGRAMME MANAGEMENT
Leadership – Decarbonisation strategy
Documenting processes
Digital Design & Management Tools

SUPPLY CHAIN MANAGEMENT
Modular system solutions
Procurement platform
Capacity in local supply chain

TRAINING & EMPLOYMENT
Theoretical and Vocational
Up-skilling & Match-making
Local Innovation Centre

COMMERCIAL MODEL
Competitive offer and AV services
Mobilising local community
Explore Broader benefits and opportunities
Öresundskraft

Patrik Hermansson
Director Strategy & Innovation
April 17, 2020
Öresundskraft AB
A comprehensive communications and energy service company

- 100% owned by City of Helsingborg
- Key data
  » 110 000 customers
  » 381 employees (38% ♀)
  » 2.9 TWh energy sales
  » 320 M€ turnover, 34 M€ EBIT
- Infrastructure
  » Heating Grid, Cooling Grid, Power Grid, Metropolitan Area Network, Gas, National EV charging, IoT Connectivity for smart cities
- Energy and service
  » District Heating, District Cooling, Electricity, Energy Efficiency Services, Comfort as a Service (CaaS)

Cooperation
Helsingborg

- Helsingborg fast growing city
  - 2018: 145,415 invånare (+1.5%)
  - 2026: 159,000 invånare
  - 2035: 175,000 invånare
  - 2050: 200,000 invånare

- 1% Sweden’s CO₂
  - 508,321 ton fossil CO₂ (2017)

- Limited electric power capacity
  - Weather dependent production, Find power in North replace nuclear plants in south
District Heating

- Founded 1965
- 80% market share and a strong brand
- Strong growth in Helsingborg and Ängelholm
- Strong customer relations
- 100% delivery accuracy
- 100% recovered and renewable energy
- Competitive price
- CHP critical for electric system
  - 20% power demand
  - Off-loading electric system
- Data driven business (customer energy data)
District Heating for Tomorrow

• Balance Sheet
  » Reinvestments in Power Plants
  » Reinvestements in Heat Grid

• Heat grid is growing but sales volume fixed
  » New customers balances energy efficiency
  » Investment

• Customer involvement
  » Demand Side management Key

• Digitalization key resource

• District Heating key for achieving climate neutrality 2035

• District Heating key for the electrical system

You Can't Solve Today's Problems With Yesterday's Solutions
Öresundskraft AB

- Founded 1859
- 400 Employees (♀36%)
- 3.4 TWh Energy Sales
- 260 M€ Turn Over
- 35 M€ EBITA
- 100,000 Customers

100% Ownership

Oresundskraft
Energy ALMO
Helsingborg
Kemira
Sulphuric Acid Plant
Helsingborg

Economic and Climate Benefits of Heat Sales

- CO2 emissions saving = 131,000 tonnes per annum
- 1,358 jobs
- Employee purchasing power £20m per year
- Lower municipal tax revenues, equivalent to 1,000 primary school places
- Primary energy generation would be 6 times higher

Kemira Sulphuric Acid Plant Helsingborg

Canadian Perspective 2 – Markham District Energy Inc.

Bruce Ander
Markham District Energy Inc.
Why are Thermal Networks required?
20th Year
Private, Non-Rate Regulated Thermal Energy Utility
Produce Hot Water, Chilled Water & Electricity
Our City’s District Energy Investment

Energy Plants
Distribution Piping
Building Connections
Power Generation

$200M
Four Municipal Investment Pillars

Financial Performance

Economic Development

Environmental Performance

Community Energy Resiliency
Why are Thermal Networks required?

Buildings are responsible for over 50% of our City’s GHG Emissions

The energy to heat and cool buildings is the dominant use in our cities

Energy networks in silos are inefficient and there are missed opportunities

Buildings as energy silos cannot adapt – networks provide scale

A thermal network is the only path forward for our City to achieve Net-Zero
Net-Zero Thermal Energy Emissions by 2050
Net-Zero Ready

Combined Heat & Power
Biomass or Solar
Heat Pumps/Ground/Sewage/Heat Recovery
Carbon Capture & Utilization
Stoke-on-Trent

Andrew Briggs
SoTCC

Sebastien Danneels
SoTCC
Stoke-on-Trent
Energy Projects

17th April 2020
Andrew Briggs – Strategic Manager Energy
Sebastien Danneels – DHN Technical Lead Manager
Stoke-on-Trent

Unitary Authority (6 towns)
250,000 inhabitants

Commonly known as “The Potteries”

Well connected
Railway network
Motorway network
4 Airports – 1 hour
Stoke-on-Trent – A Smart Sustainable City

Stoke-on-Trent City Council is looking to transform the city over the next 30 years, through investment in energy, smart systems integration, site development, skills and innovation - creating new homes and new jobs.

- Secure, low carbon, affordable energy
- Gigabit Full Fibre Network
- Smart Systems Innovation
Energy Efficiency Measures

With partners exploring future options for Energy to satisfy long-term needs and developing local infrastructure to support delivery of our ambitions

Adopting an efficiency first approach

In delivery:
• £2m Investment in LED lighting retrofit to core council estate
• £7.8m LED street light replacement programme

In development:
• Micro CHP at strategic sites
• BMS upgrade and replacement programme
• Wider energy efficiency measures across the council estate
• Building heating review
Solar & Community Energy Scheme

Community Energy Scheme
• Over 6000 sign ups to Community Energy Scheme
• 4500+ installed Solar PV systems to date on city’s social housing stock
• £24m investment, 10,000 tonnes p.a. carbon saving
• New phase opened to wider customer base in the city

Corporate estate
• Roof tops and ground mount options
• Evaluation estimates potential for an estimated 25MWe generating capacity

<table>
<thead>
<tr>
<th>Spec. Annual Yield</th>
<th>960.75 kWh/yr/p</th>
<th>Performance Ratio (PR)</th>
<th>95.5 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield Reduction due to Shading</td>
<td>5.0 %/year</td>
<td>CO₂ Emissions avoided</td>
<td>31,580 kg/year</td>
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Energy from Waste

- Replacement of current 180Kt Facility
- Current plant venting hot air to atmosphere
- A new more efficient facility from 2025 with full heat recovery with integration into DHN and SMART Energy network
- Potential £300m investment in construction and equipment
DHN Scheme

45GWh annual demand

- Circa 18km network
- Circa 100 buildings
- Deep Geothermal (Private Sector)
- Energy from Waste Plant
- Interim/Backup Heat Generation
- SCADA system
- Various O&M packages

4 Clusters:
- Festival Park
- Hanley
- UniQ
- Stoke
Panel Discussion
Why Heat Networks Work
Reference projects

Malmö
Property owner: Catena
Project owner: Hallbygg
Tenant: DHL
Build area: 11 000 sqm
Role: Supplier of turnkey solution (Hallbygg)

Malmö
Property owner: Pågensbageri
Project owner: Hallbygg
Tenant: HyrIn
Build area: 1 000 kvm
Role: Supplier of turnkey solution (Hallbygg)