HEAT ACADEMY ONLINE

Getting to Net Zero:
Decarbonizing Heating & Cooling – 1B

21st May: 10.00 – 11.30 (EDT)
Introduction

Christina Keighren
Business Sweden
### AGENDA

Getting to Net Zero – Decarbonizing Heating & Cooling – Session 1B

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
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<tbody>
<tr>
<td>10:00 – 10:10 AM</td>
<td>Introduction</td>
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</table>
| 10:10 – 10:20 AM | Recap of Session 1A
   - This session will provide an overview of the major takeaways from the first webinar. |
| 10:20 – 10:50 AM | Who and what does it take to make it happen?
   - A decision has been made to build a thermal network, but what happens next?
   - What does it take to go from concept to implementation? This session will explore next steps: who needs to be involved in the process and what is needed to get a thermal network off the ground. |
| 10:50 – 11:10 AM | How to mobilize stakeholders?
   - This panel session will explore how to mobilize internal and external stakeholders, whose participation will be vital in moving from concept to implementation. |
| 11:10 – 11:30 AM | Summary and Q&A session                                               |
SPEAKERS

Presentation

George Dobson
Head of Heat Projects North, Department of Business, Energy and Industrial Strategy
London, United Kingdom

Tanja Groth
Head of Urban Energy at Sweco
London, United Kingdom

Jamie Stephen
Managing Director at TorchLight Bioresources
Ottawa, Ontario, Canada

Bruce Ander
President & CEO of Markham District Energy (MDE)

Herb Sinnock
Director – Sustainability for Sheridan College in Oakville, Ontario

Fernando Carou
Manager, City of Toronto – Environment & Energy Division

Peter Anderberg - pa@nordheat.eu / (+46) 70 56 111 99

HEAT ACADEMY INTERNATIONAL
Recap of Session 1A

Peter Anderberg
Heat Academy
NORDIC HEAT
Peer-to-Peer Advisory Services – From Vision to Operations

EXAMPLES ON CUSTOMERS & PARTNERS

250 PROFESSIONALS
FROM 20 MARKETS

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250 PROFESSIONALS
FROM 20 MARKETS

Peter Anderberg - pa@nordheat.eu / +46 70 56 111 99
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

Canada
US
China
India
UAE
HEAT ACADEMY
Securing Capacity and Quality

THERMAL NETWORKS

Market Share

25 Million * Pipes

2020
2030
(time)

2% 20%
Heat Academy
Securing Capacity and Quality

Products & Services

Heat Generation
- HARDWARE (examples)
  - Building
  - Boilers
  - Pipes
  - Electrical components
  - Pollution control
- SERVICES (examples)
  - Welding
  - Handling of heavy goods
  - Logistics & Stock
  - Installation
  - Engineering
  - Construction/Civil Works

Distribution
- HARDWARE (examples)
  - Pipes
  - Fittings
  - Joints
  - Valves
  - Leak detection system
- SERVICES (examples)
  - GPR/3d mapping
  - Civil Works
  - Installation & Welding
  - Logistics & Stock
  - Leak detection
  - Operations & Maintenance

Connect & Control
- HARDWARE (examples)
  - HIUs
  - Indoor Piping
  - Electrical components
  - Metering System
  - Digital solutions
- SERVICES (examples)
  - Installation
  - Civil Works
  - Plumbing
  - Welding
  - Leak detection
  - Operations & Maintenance

Energy Efficiency
- HARDWARE (examples)
  - Insulation systems
  - Radiators
  - Windows
  - Monitoring & Control
  - Digital solutions
- SERVICES (examples)
  - Civil Works
  - Installation
  - Surveillance and screening
  - Construction
  - Retrofit
  - Bench Marking

Customer Management
- HARDWARE (examples)
  - IT Hardware
  - Billing systems
  - IoT solutions
  - Integration technologies
  - Intelligent Heating Pack
- SERVICES (examples)
  - Billing Services
  - Customer Care services
  - Sales Support services
  - Internet connection
  - Mobile solutions
  - CSR support

Programme Management

Quality & Documentation

Health & Safety

O&M

Installation & O&M
EXECUTION INTELLIGENCE
HEAT ACADEMY
Securing buy-in from key stakeholders

KEY AREAS

- POLITICAL DECISION MAKERS
  - POLITICAL STRATEGY
  - SUPPLY CHAIN MANAGEMENT

- CUSTOMERS
  - COMMERCIAL STRATEGY
  - BUSINESS MODEL
  - TRAINING & RESOURCING

- INVESTORS
  - FINANCING STRATEGY

- BROADER PUBLIC
  - COMMUNICATION STRATEGY

- PROGRAMME MANAGEMENT
  - TECHNICAL DESIGN

- HEAT ACADEMY
  - Affordable Heating
  - 13 Peter Anderberg - pa@heatnet.se / +46 70 56 111 99
HEAT ACADEMY
Securing buy-in from key stake holders

KEY STAKEHOLDERS
WHAT’S IN DEMAND

Overview

DECARBONISING HEATING & COOLING
RAPIDLY GROWING MARKET

PROSPECTS FOR YOUNGER GENERATIONS

ECOLOGICAL CRISIS
ENERGY CRISIS
CLIMATE CRISIS
NATURAL RESOURCES
SOCIAL
GLOBAL PANDEMIC
FINANCIAL CRISIS
BALANCE-OF-TRADE
JOBS
RESILIENCE
WHAT’S IN DEMAND
Overview

UK HEATING SECTOR - 2019
FOSSIL FUELS

PRIMARY ENERGY

CONSUMPTION

CO2

HEAT 48%

HEAT 35%

ELECTRICITY 13%

TRANSPORT 39%

PRIMARY ENERGY

CONSUMPTION

CO2

HEAT 48%

HEAT 35%

ELECTRICITY 13%

TRANSPORT 39%

UK HEATING SECTOR - 2019
FOSSIL FUELS
OPTIONS & STRATEGIES
Why change unless you have to?

(time)

1964  1971
OPTIONS & STRATEGIES
Why change unless you have to?

1964 1971 1973

1973

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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
MARKET SHARE – HEAT NETWORKS

Market Share: 60%
Fossil Fuel: 3%

HEAT SOURCES

OPTIONS & STRATEGIES
Why change unless you have to?

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1964 1971 1975 2012 (time)

0 10 20 30 40 50 60 70

0 10 20 30 40 50 60 70
OPTIONS & STRATEGIES
Why change unless you have to?

STOCKHOLM

Market Share:
>90%

HEAT SOURCES
OPTIONS & STRATEGIES

Heat Networks

1964
FOSSIL FUELS >90%

2020
FOSSIL FUELS <10%

Heat Pumps
Industrial Waste Heat

Solar Thermal
Energy from Waste

Biogas

Waste Wood

Geothermal

Sewage Water

Mine Heat

Biomass
1964

**Fossil Fuels >90%**

- Energy Security & BoT
- £5BN annually

2020

**Fossil Fuels <10%**

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

- Energy Security & BoT
- Local Resilience
- Investments
- Social Welfare
- Green Agenda
- End User Convenience

- £25BN annually
OPTIONS & STRATEGIES
Net Zero Ready

1964
1971
1975
2012

Net Zero Ready 1
Net Zero Ready 2
Net Zero DONE!
OPTIONS & STRATEGIES
Why change unless you have to?

ORGANIC GROWTH: 1964 - 2019

Customers

50

1964
1971
1975

60 Km

500 000
WHAT’S IN DEMAND

Overview

DECARBONISING HEATING & COOLING
RAPIDLY GROWING MARKET
HEAT ACADEMY
Securing Capacity and Quality

THERMAL NETWORKS

Market Share

<table>
<thead>
<tr>
<th>Year</th>
<th>Market Share</th>
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<tbody>
<tr>
<td>2020</td>
<td>2%</td>
</tr>
<tr>
<td>2030</td>
<td>20%</td>
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(time)
Getting to Net Zero: Decarbonizing Heating & Cooling
Session 1A

Herbert Sinnock, Sheridan College
May 14, 2020
Why do we integrate with thermal networks?

- Ability to capture and distribute otherwise wasted heat
- Flexibility to incorporate new thermal sources
- Economies of scale
- Flexibility to expand integration networks
- Ability to incorporate thermal storage
- Fuel flexibility
Canadian Perspective 2 – Markham District Energy Inc.

Bruce Ander
Markham District Energy Inc.
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 Ready
Combined Heat & Power
Biomass or Solar
Heat Pumps/Ground/Sewage/Heat Recovery
Carbon Capture & Utilization
Canadian Perspective 3 – City of Toronto

Fernando Carou
City of Toronto
Development of low-carbon District Energy

Fernando Carou, B.ASc.P.Eng.
Environment and Energy Division
Why low-carbon District Energy?

1. Decarbonize buildings, including growth

2. Lower $/tCO2 reduced vs single-building solutions (neighbourhood scale & multi-building developments)

3. Ability to access large renewable sources
Decarbonize buildings which represent 50% of emissions.
The UK Heat Networks Market

George Dobson
Head of Heat Projects North,
Department of Business, Energy and Industrial Strategy, UK
THE UK HEAT NETWORKS MARKET

The Department for Business Energy and Industrial Strategy 2020 perspective
The UK decarbonisation agenda

• Through the Climate Change Act (2008) we are legally obligated to decarbonise and were the first country in the G20 to commit to “net zero” emissions by 2050.

• Heating is essential to our lives – it is the biggest reason we consume energy in our society and is responsible for over a third of our emissions.

• The role of Heat Networks was introduced in The Future of Heating and updated in the Clean Growth Strategy which sets out the vital role heat networks play in the long term decarbonisation of heat.

• These documents set out our understanding that Heat networks will strongly contribute to our transition into an affordable, clean and flexible energy infrastructure – safeguarding our future economic security.
The UK decarbonisation agenda

Carbon Budgets

Figure 3: UK carbon budgets and 2050 target

Was 80% now: Net Zero
How much does the heat sector contribute to the UK’s carbon emissions?

At 21% heating, cooling and hot water in buildings is one of the biggest sources of UK carbon emissions. Much of this can be attributed to individual gas boilers that produce 85% of heating in homes.
THE OPPORTUNITY
How significant a role might Heat Networks play?

- The illustrative scenarios in the Clean Growth Strategy suggested that HNs could provide between 17-24% of UK heat demand by 2050.

- Analysis by Element Energy for the CCC projected:
  - 9% (42 TWh) in 2030 and
  - 18% (81 TWh) in 2050.

An estimated £22 billion investment needed by the sector by 2050 to achieve this.

Why heat networks?

Heat Networks can be both lower carbon and cheaper for consumers than a building level solution. They can also take advantage of natural and waste heat sources that individual solutions can not.
Heat networks: the market now

- 480,000 consumers are spread across 14,000 heat networks in the UK, of which 2,000 are classed as district heating networks.

- Heat networks provide around 2.4% of heat for buildings in the UK, a proportion that has been growing at a rate of 3.6% per annum.

- District heating networks currently supply around 10TWh of annual heat demand.

- The majority of heat networks are currently natural gas fired CHP with peaking boilers (91%).

(The experimental statistics may not wholly reflect the true position of the current heat network market due to networks not reporting or providing incorrect returns)
GOVERNMENT FOCUS
Vision: Help to support the development of a self-sustaining heat networks market by the mid 2020s

<table>
<thead>
<tr>
<th>Heat Network Market Development</th>
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<tbody>
<tr>
<td><strong>Heat Network Delivery Unit</strong></td>
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<tr>
<td>Established in 2013 to support Local Authority projects providing support, guidance and funding for techno economic feasibility studies.</td>
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<tr>
<td>2013</td>
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<tr>
<td><strong>Heat Metering and Billing Regulations</strong></td>
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<tr>
<td>Set in law in 2014 these require heat suppliers to install and bill using consumption heat meters, where cost effective to do so.</td>
</tr>
<tr>
<td>2014</td>
</tr>
<tr>
<td><strong>Heat Network Investment Project</strong></td>
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<tr>
<td>The pilot scheme was established in 2016 and the full scheme in 2018 to provide £320 million in capital match funding to projects.</td>
</tr>
<tr>
<td>2016</td>
</tr>
<tr>
<td><strong>Market Framework</strong></td>
</tr>
<tr>
<td>Consultation on the development of policy to implement the regulation of new and existing heat networks in 2019 and 2020.</td>
</tr>
<tr>
<td>2019 +</td>
</tr>
<tr>
<td><strong>Green Heat Network Fund</strong></td>
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<tr>
<td>The Government will invest a further £270 million in a new Green HNs Scheme, enabling new and existing heat networks to be low carbon and connect to waste heat.</td>
</tr>
<tr>
<td>2022 +</td>
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Heat networks: a market to invest in
Industry led schemes:
Heat Trust and technical Code of Practice
Heat Network Market Framework

Supporting the market

Consumer protection

Decarbonisation
Supporting market growth & investment

Building HNs’ reputation and regulatory certainty
- Introduction of regulatory framework equivalent to other critical infrastructure markets
- Driving up poor performing networks’ outcomes

Reducing development burden and risks
- Consideration of rights and powers equivalent to other utilities
- Developing standardised project documentation and guidance

Improving investor understanding of costs and returns
- Publishing whole life cost of heat tool
- Sharing anonymised project data and learning from HNIP

Supporting heat networks as local solution
- Promoting local development of heat (network) zones where appropriate
- How to ensure Building Regulations enable heat networks rather than act as barrier – SAP and Part L
Heat networks: a market to invest in
Heat Networks Delivery Unit (HNDU)

- 10 rounds of development funding
- ~£25m in grants
- 50-67% funding available
- 140+ Local Authorities
- 220+ projects/ 500+ opportunities
Why Local Authorities are key to the delivery of Heat Networks & low carbon heat in the UK

- Key local property asset owners and heat users (anchor loads)
- Local relationships with key stakeholders
- They have a responsibility for and understanding of their local areas
- They are looking at decarbonisation (local net zero/climate emergencies)
2020 Q1 Capex pipeline

- £1.26 billion total
- £51m is currently under construction
- £65m HNIP funding released leveraging £650m of HNIP projects
- £667m of HNDU in project pipeline
PROJECT ECONOMICS
Heat networks: HNDU pipeline forecast returns

- Heat networks provide access to long term stable cash flows with a reasonable return on investment;
- These and other factors make heat networks an exciting UK investment opportunity.

Project IRR (40 year pre-tax real) – 45 of HNDU projects:
- Average – 6.8%
- Median – 6.4%
- 75th Percentile – 8.0%
- 25th Percentile – 4.92%
Key Learnings
Key Learnings

1. The market is not homogenous
2. High upfront capital costs
3. Project development and transaction costs can be significant
4. Challenges of an immature unregulated market
5. Economic in areas of high heat density or expensive counterfactual
6. LAs have critical role as sponsor, coordinator, honest broker, planning…
7. Evaluate a heat network against alternative ways of delivering the benefits you want to realise locally
8. Aligning timing of customer need and completing construction can be difficult
UK – Context & Trends

Tanja Groth
Head of Urban Energy at Sweco
London, United Kingdom
HEAT ACADEMY
GETTING TO NET ZERO: DECARBONISING HEATING AND COOLING

21 MAY 2020
Agenda

• UK political landscape supporting heat networks
  – How this has changed
  – Where we are right now
  – What are the priorities for the future

• UK heat network industry – where are they now and where are they going?
The UK political landscape has launched multiple initiatives to support the development of the UK heat network industry

- **2011**
  - Scottish District Heat Loan Fund

- **2013**
  - Heat Network Delivery Unit

- **2013**
  - Heat Network Partnership

- **2015**
  - Low Carbon Infrastructure Transition Programme

- **2016**
  - Heat Network Investment Project Pilot

- **£15m over 50 projects**
- **£6 million in first 18 months**
- **£xx**
- **£76 million**
- **£320 million fund**
The status of the UK heat network industry today and how we need to develop to achieve our potential

Today
Insert text

2-4%

2020-2050
Insert text

?%

2050
Insert text

18-20%
Priorities for the future of UK heat network sector and the challenges we face in the industry
The UK heat network industry has seen a marked shift over the last five years
Canadian Development

Jamie Stephen  
Managing Director, TorchLight Bioresources
Panel

Christina Keighren
Business Sweden

Peter Anderberg
Heat Academy
Summary and Q&A

Lars Henriksson
Consulate of Sweden
Next Step

Christina Keighren
Business Sweden

Peter Anderberg
Heat Academy
HEAT ACADEMY
Securing Capacity and Quality

COLLABORATIVE MODEL

CANADA
US
CHINA
INDIA
UAE

COLLEGES
UNIVERSITIES
PUBLIC INSTITUTIONS
SUPPLY CHAIN