CIBSE Young Energy Performance Group (YEPG)

Phil Jones (Building Energy Solutions)
Chris Grainger (Buro Happold)

23rd March 2016
DISTRICT HEATING RULES ...... ok!
(In the right place!)

Phil Jones
CEng MSc FCIBSE MFI MASHRAE
Chairman CIBSE CHP-DH Group
Building Energy Solutions
07714 203 045
philjones100@virginmedia.com

www.cibse.org/CP1
THERMAL STORAGE

Olympic Park
RULE 1 – size to ‘real’ heat demand

- Heat demands are falling - are modern homes the right place for DH?
- Smaller systems may not be viable?
- Heat demand per kilometre is crucial
RULE 2

Use high insulation standards....

& low return temperatures....

& wide Delta T

70/50C ?

Changing the 82/71C mentality!
WIDER $\Delta T$

Figure 8: Relationship between cost of pipe work installation and differential temperature on a system

Figure 9: Heat network system capacity variation in relation to pipe diameter and temperature difference

Cheaper pipes

Greater capacity
HEAT LOSS

Typically below 15%, 10% on a good system
Outer casing made of high-density polyethylene

Diffusion barrier made of aluminium foil

Polyurethane foam insulation for use in temperatures from -60°C to +140°C

Copper wires that monitor for leaks

Service pipe made of steel, copper, PEX or aluminium/PEX
RULE 3  Think PEX!
Pre-insulated fl-EX-ible
RULE 4 – seek soft dig v hard dig

Cost ~£500/m - £1500/m
RULE 5 – Thorough feasibility studies

- Heat and electricity demand must be properly assessed to prevent oversizing
- Whole life costs including maintenance & tax

![LOAD DURATION CURVE](image)

- **Thermal store discharging**
- **Heat demand**
- **Thermal store charging**
- **Boiler**
- **CHP**

**Heat demand and load duration curve**

- **MW (Power)** vs. **HOURS**
EnergyPro software
RULE 6 – Whole Life Costing
NET PRESENT VALUE

NPV (£)
RULE 7 – include storage

• PIMLICO oldest district heating system in the UK
• established in 1950
• 3.1 MWe & 4.0 MWTh of CHP engines
• 3 x 8 MW gas fired boilers
• 2,500 cubic metre heat storage
COMMUNITY (DISTRICT) HEATING SYSTEMS

RULE 8 – A MIX OF LOW CARBON TECHNOLOGIES
Supplying heat from a central source allows a range of options including CHP, SWSHP, GSHP & biomass

RULE 9 – A MIX OF BUILDING TYPES
Adding different building loads together gives a steady base load for the central plant

DH is an enabling technology
RULE 10 – Size matters!
1.6 MWe Jenbacher CHP (Clarke Energy) University of Edinburgh
DISTRICT HEATING INTERFACE UNITS

- Replaces the boiler in individual buildings

RULE 11 – Use the right diversity, commission & control
DH Thermal substation

Main components
1. Heat exchanger (domestic hot water)
2. Heat exchanger (heating)
3. Combi box including control centre and pump switches
4. Control valve, heating
5. Pump, heating
6. Control valve, domestic hot water
7. Pump, domestic hot water circulation
Heat mapping & Building clusters

RULE 12 - Look for Anchor loads
RULE 13 - Linear Heat Density

Heat demand per kilometre is crucial

Target >2 MWh/m
The need for standards

» Not always delivering on promises
» ADE market research
» Anecdotal evidence
» Huw Blackwell’s CIBSE Journal article (August 2013)
  – Poor pipework specification
  – Lack of insulation continuity
  – High operating temperatures
  – Poor pipework layout
  – Poor pumping and flow control
  – Lack of accurate metering
  – Poor commissioning

» A threat to the sector
The Code of Practice

• Voluntary
• Minimum standards, not guidance
• New build & existing
• Small & large heat networks
• Technology neutral
• Not district cooling
• For the whole supply chain
• For client tendering
• Underpin training
• Launched July 2015
HEAT NETWORKS: PLAN OF WORK

A. Avoid oversizing
B. Achieve low heat losses
C. Low return/flow temperatures
D. Variable flow control
E. Low carbon heat sources
F. Risks and environmental impacts

AIMS:
- Provide a cost-competitive heat supply
- Maintain a high level of reliability in heat supply
- Reduce CO₂ emissions and energy usage

STAGES
1. Preparation and brief
2. Feasibility
3. Design
4. Construction
5. Commissioning
6. Operation + maintenance
7. Customer expectations/obligations

Responsibilities
- Developer/Owner
- Designer
- Constructor
- Operator
- Customer

A more integrated supply chain
1. Preparation and briefing

Objectives:

1.1 To commission the project in accordance with the Code of Practice
1.2 To agree contracts that are fair and equitable with customers
1.3 To define appropriate service levels for the heat supply
2. Feasibility

Objectives:

2.1 To achieve sufficient accuracy of peak heat demands and annual heat consumptions
2.2 To identify the most suitable low carbon heat energy sources and location of an energy centre
2.3 To determine the location of top-up and standby boilers and use of existing boilers
2.4 To select suitable operating temperatures
2.5 To define heat network distribution routes, pipe sizes and costs
2.6 To determine building connection costs including heat metering
2.7 To minimise the negative impacts of phasing of the development
2.8 To assess operation and maintenance needs and costs
2.9 To conduct a consistent economic analysis and options appraisals
2.10 To analyse risks and carry out a sensitivity analysis
2.11 To assess environmental impacts and benefits
2.12 To develop preferred business structures, contract strategy and
New CIBSE written style

‘Shall’ rather than should
7. Customer expectations and obligations

Objectives:

7.1 To provide reports on energy supply and use and bills that are clear and informative

7.2 To develop communications with customers that meet customer expectations

7.3 Obligations to be met by customers
Key goals that run across all stages of the plan of work

A. Correct sizing of plant and network
B. Low heat losses
C. Low return temperatures
D. Use of variable volume control
E. Use low carbon heat supply
F. Safe, high quality, low environmental impact systems

But these goals are linked!
Training, certification & registration

- To ensure implementation of standards
- DECC pump priming funding
- 3 day training course
- **1st day: introductory client overview**
- Days: 2 & 3 technical plus short exam, leading to certification
- www.cibse.org/CP1training
- Similar to DEC/EPC training & registration
- Piloted in June 2015
Conclusions

- Successful CIBSE/ADE partnership
- Gained industry consensus
- Regular review
  - Best practice becomes minimum standard?
- Already being used in tendering
  - Indicates the need for standards
- Trained assessors in place
- Checking and policing
  - Maybe in future?
CP1 - Feedback

Heat networks:
Code of Practice for the UK
Raising standards for heat supply

CP2 - published

Surface water source heat pumps:
Code of Practice for the UK
Harnessing energy from the sea, rivers, canals and lakes

www.cibse.org/CP1feedback   www.cibse.org/CP2
NEXT STEPS

› Look for high heat density opportunities

› Look for existing heat networks

› If you are thinking of developing/connecting to a district heating scheme then......
  – DOWNLOAD A COPY OF THE CODE OF PRACTICE
  – FIND A TRAINED HEAT NETWORKS ASSESSOR
  – CARRY OUT A THOROUGH FEASIBILITY STUDY

www.cibse.org/CP1
May the Code be with you….
Raising standards for heat supply

Phil Jones
CEng MSc FCIBSE MEI MASHRAE
Chairman CIBSE CHP-DH Group
Building Energy Solutions
07714 203 045
philjones100@virginmedia.com

www.cibse.org/CP1
INCORPORATING HEAT NETWORK MODELLING IN NATIONAL ENERGY FORECASTS

23rd March 2016
OUR CITIES DH EXPERIENCE

2011
Decentralised Energy Capacity Study
Greater London Authority

2011
Geological Heat Storage Feasibility
ETI

2012
Secondary Heat Study
Greater London Authority

2013
Local council heat network plans
Local authority (various)

2015
2050 cost calculator
ETI

2016
80 x 50 SMART cities plan
NYC Mayors Office
NATIONAL GRID FUTURE ENERGY SCENARIOS

INCREASED PROSPERITY

CONSUMER POWER

GONE GREEN

NO PROGRESSION

SLOW PROGRESSION

INCREASED GREEN AMBITION
FROM CIBSE YEPG:

This study is reviewing existing heat networks, the location and potential scale of economic heat networks and sources of low carbon heat production that could support a future heat network.

More slides on this project will become available in Summer 2016 after research is completed.

In the meantime, please see:

http://fes.nationalgrid.com/

https://medium.com/future-energy-scenarios/future-of-heat-f8cfaac1b570#.n0ciiz7zi
CIBSE Young Energy Performance Group (YEPG)

CARBON BITE NIGHTS

Q & A

Phil Jones (Business Energy Solutions)
Chris Grainger (Buro Happold)

23rd March 2016
Follow Us!

CIBSE Website
www.cibse.org/Networks/Groups/Young-Energy-Performance-Group

LinkedIn
“CIBSE Young Energy Performance Group”

Twitter
@CIBSEyepg

To become an official member of the group – please email groups@cibse.org stating that you would like to join the Young Energy Performance Group