DISTRICT HEATING RULES …… ok!
(In the right place!)

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www.cibse.org/CP1
DISTRICT HEATING

In high heat density areas
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 ΔT**

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

Figure 11: Indicative heat losses from insulated pipes and relative performance of series 1-3
Outer casing made of high-density polyethylene

Diffusion barrier made of aluminum 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 aluminum/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.
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
PIMLICO DISTRICT HEATING SCHEME

Key
- Pipelines installed to date
- Buildings connected to the scheme
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. Combiobox 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

Standards not set before Projects often go wrong at this early stage
Objective 3.8 – To select heat metering, prepayment and billing systems that are accurate and cost-effective

Why is this objective important?
Customer acceptance of a heat metering system is important if revenues are to be secure and customer satisfaction with the overall system maintained. Individual dwelling heat meters are a requirement under the Energy Efficiency Directive (EED) for all new buildings and for buildings undergoing major refurbishment. Building-level meters are also a requirement under the EED for all multi-apartment/multi-purpose buildings connected to a heat network. All other premises served by a heat network must undertake cost effectiveness and technical feasibility assessments for the installation of individual meters of heat cost allocators. Other heat meters may be installed to aid the operator in managing the heat network and to provide a greater understanding of where heat is being lost.

Minimum requirements

3.8.1 Heat meters shall be in accordance with the Measuring Instruments Directive (MiC) and shall be Class 2 accuracy.

3.8.2 Metering of heat, electricity and fuel may also need to be in accordance with requirements of the Renewable Heat Incentive as published by Ofgem, or the CHPQA scheme as required for the individual energy centre solution.

3.8.3 Heat meters shall be of the type with no moving parts in the water flow measurement component, ultrasonic meters are most commonly used.

3.8.4 The minimum static pressure stated by the heat meter manufacturer shall be met at all times for each meter and this requirement shall be taken into account in the overall hydraulic design; if cavitation occurs this can severely impact the accuracy of the meter.

3.8.5 A strainer shall be fitted upstream of the meter with a mesh size as advised by the manufacturer.

3.8.6 The meter installation shall be designed taking account of the manufacturer’s recommendations with respect to orientation, the minimum length of straight pipe before and after the meter and ensuring that it is possible to easily access the meter and integrator for maintenance, calibration and taking readings.

3.8.7 Heat meters shall be fitted with security seals to reduce the potential for fraud and preferably within a tamper-proof enclosure which may be formed by the HIU cover.

3.8.8 A pre-payment system (where fitted) shall have an emergency facility whereby a limited amount of heat energy can be purchased before automatic disconnection results; a range of routes to make payments shall be provided including online and mobile phone as well as from local retail outlets and the local management office.

3.8.9 On larger schemes (more than 250 dwellings) a full Automatic Meter Reading (AMR) system shall be specified to record and report:
— heat sent out from central plant
— heat delivered to each main building
— heat delivered to each dwelling.

Note: Direct data readings should be obtained using M-bus communications or other proven AMR technology. Heat meters that provide data via pulsed outputs are not normally recommended for use with AMR systems.

3.8.10 Where mains energy is not non-volatile memory included, where savings over lifetime of 5 years

3.8.11 In addition to installation containing multiple heat exchanger buildings.

3.8.12 The minimum free billing shall be quick and businesses and customers.

Minimum Requirements

✓ 3.5.1 the design shall seek to minimise the total length of the network

✓ 3.5.2 the type and thickness of insulation shall be selected to minimise lifecycle costs i.e. balancing additional capital cost with the value of the heat energy saved, and shall take account of degradation of the insulation over time

Figure 13 Typical heat meter (reproduced courtesy of Vital Energi)

Best practice

Best practice could include the use of metering data to provide feedback to customers on the heat used compared to norms and advice on how to manage their consumption. For non-residential customers the monitoring of heat demand profiles on say a half-hour basis may enable both parties to identify control modifications that would reduce peak demands or change the timing of peak demands for the benefit of the heat network and hence result in lower customer costs.

To provide future proofing and a change of heat supplier best practice could involve the provision of AMR systems that comply with the Open Metering System standard.
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](http://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
Heat networks:
Code of Practice for the UK

Client checklists

www.cibse.org/CP1checklists

Based on:
CP1, 2015
4.2 Stage sign-off sheets (from Stages 1 and 5 for illustration)

Stage 1 – Preparation and briefing

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<th>Summary</th>
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<td>Have the agreed performance targets been set?:</td>
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<td>Has CP1 been followed?:</td>
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<td>Has all required documentation been supplied for the evidence pack:</td>
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### 4.3 Overall project summary

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<th>Stage 1 - BRIEFING</th>
<th>Stage 2 - FEASIBILITY</th>
<th>Stage 3 - DESIGN</th>
<th>Stage 4 - CONSTRUCTION</th>
<th>Stage 5 - COMMISSIONING</th>
<th>Stage 6 - OPERATION</th>
<th>Stage 7 - CUSTOMER EXPECTATIONS AND OBLIGATIONS</th>
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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

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