

Application Form: APPF:01

Application guide for entry of heat network performance data
in SAP Products Characteristics Database

Issue 1.1

DOCUMENT REVISIONS

Documents will be revised by issue of updated editions or amendments. Revised documents will be posted on the website at www.ncm-pcdb.org.uk/sap.

Technical or other changes which affect product recognition requirements (for example) will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments.

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

Users of this document should ensure that they possess the latest issue.

DOCUMENT REVISION LOG

DATE	VERSION NO.	AMENDMENT DETAILS	APPROVED BY
20.11.14	1.0	First issue	PI
26.05.16	1.1	Amended Figure 1 & Table 1	PI

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 2 of 32

TABLE OF CONTENTS

1.	INTRODUCTION	4
2.	SCOPE.....	6
3.	DATA ENTRY PROCESS	7
4.	AMENDING DATA ENTRIES	9
	4.1 Due to general heat network modification	9
	4.2 Due to new network construction phases	11
5.	APPLICATION TECHNICAL GUIDANCE	13
	5.1 Worksheet 1: Background information.....	13
	5.2 Worksheet 2: Heat supplied	15
	5.3 Worksheet 3: Energy Centre	17
	5.4 Worksheet 4: Heat generators in the energy centre(s)	22
6.	DATA PROCESSING FOR PCDB DATA ENTRY	23
7.	PCDB RECORD MAINTENANCE REQUIREMENTS	24
	7.1 Frequency of data provision	24
8.	AUDITING	26
	APPENDIX 1: MONTHLY HEAT SUPPLY TO NETWORK PROFILE	28
	APPENDIX 2 – DISTRIBUTION LOSS FACTOR CONSTRAINTS.....	29
	APPENDIX 3 - PCDB HEAT NETWORK DATA FORMAT	31

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 3 of 32

1. INTRODUCTION

Building energy performance assessments are produced using the National Calculation Methodologies for energy rating buildings (NCMs). The NCMs are a range of assessment methodologies comprising the Standard Assessment Procedure for Energy Rating of Dwellings (SAP), Reduced Data SAP (RdSAP), which is used to assess existing dwellings, and the Simplified Building Energy Model (SBEM), which is used to assess non-domestic buildings.

The Building Research Establishment Ltd is currently contracted to maintain and develop all NCMs on behalf of Government.

Building energy assessment methodologies are used to deliver multiple Government policy initiatives. These range from Building Regulation compliance checks and the production of Energy Performance Certificates, which satisfy the UK's obligations under the European Performance of Buildings Directive (EPBD), to supporting the Green Deal and Energy Companies Obligation (ECO) schemes by enabling the differentiation of improvements measures. Assessing the performance of a measure is complex and it may not always be possible to describe in terms of a simple number for comparison purposes. In such instances the assessment of performance is only possible using building energy performance assessments that utilise specific product performance data.

In order to assess a building's energy performance, information is needed that describes the energy performance of the building fabric and building services. Such product performance data is either generic, determined by the materials and type of product used ('type data') or specific, where validated individual branded product performance data has been made available ('product data'). Product performance data for the NCMs is normally held in the Product Characteristics Database (PCDB). The Building Research Establishment Ltd acts as the PCDB Administrator.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 4 of 32

It is estimated that heat networks supply 1-2% of the dwellings in the UK¹. Local and central Government policy, particularly planning requirements and building regulation amendments, has resulted in many new-build dwellings being connected to heat networks for the provision of space heating and hot water services. For example, developers in London committed to communal heat networks for 43,000 new-build dwellings in 2013 as part of approved strategic scale planning applications².

In view of the increased prevalence of heat networks and concerns regarding the generality of heat network default values in SAP, the SAP 2012 update has enabled the entry of heat network data in the PCDB. The voluntary entry of heat network performance information in the PCDB will assist SAP assessors in delivering robust assessments by using validated data. The existing provision of default values will remain in SAP 2012, but removal is being considered for the SAP 2015 update.

This document provides guidance for the entry of heat network performance data in the PCDB by the Network Operator³, in particular the completion of the "*SAP PCDB Application Workbook for Heat Networks*".

¹ District heating - heat metering cost benefit analysis report, DECC May 2012

² Monitoring the implementation of GLA planning policies in 2013, GLA July 2014

³ The Network Operator may be the Heat Network owner or a suitably qualified organisation or individual appointed by them

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 5 of 32

2. SCOPE

Heat networks are only eligible for PCDB data entry in the following cases:

- 1) An existing heat network serving existing dwellings
- 2) A planned heat network serving dwellings with detailed planning permission
- 3) A planned heat network serving existing dwellings
- 4) A combination of the above

Heat networks that are planned to serve new dwellings with only outline planning permission (or no planning permission) will not be accepted for data entry.

Applications for data entry which are based on planned networks will be classified as provisional until they are constructed and actual metered data has been provided for validation purposes.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 6 of 32

3. DATA ENTRY PROCESS

Where the Network Operator requires the entry of Heat Network performance data in the PCDB, they must follow the process defined below:

Step 1:

The Network Operator wishing to enter Heat Network performance data in the PCDB, or amend an existing data entry, visits the Building Energy Performance Support Website: <http://www.ncm-pcdb.org.uk/sap> and downloads the "SAP PCDB Application Workbook for Heat Networks" and this document.

Step 2:

The Network Operator collects the following heat network characteristics:

- List of connected buildings and monthly heat energy supplied to them
- Details of installed plant and existing metering
- Monthly heat energy supplied to the network and, where applicable, electricity generation figures
- Monthly fuel consumption for each fuel used

Step 3:

The Network Operator completes the "SAP PCDB Application Workbook for Heat Networks" and submits to saproductlisting@bre.co.uk for review by the PCDB Administrator. The Network Operator must ensure the latest workbook format is completed, which will be kept up-to-date at: <http://www.ncm-pcdb.org.uk/sap>. This workbook requires the following information:

- Background information on the heat network
- Heat supplied to buildings
- Annual energy input and output from the network
- Information on the heat generators
- Confirm if estimated or actual energy consumption data

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 7 of 32

Step 4⁴:

The PCDB Administrator issues a proposal for data processing works and if acceptable to the Network Operator the application proceeds to Step 5.

Step 5:

The PCDB Administrator reviews the application workbook and reports any missing or unsatisfactory data to the Network Operator. Further clarification or evidence of performance claims may also be requested.

Step 6:

The Network Operator resolves the issues highlighted in Step 5 and supplies a revised workbook, whilst ensuring that the workbook revision date is amended.

Note: Several iterations between Step 5 and 6 may occur in practice, but the proposal for data processing works will limit these iterations.

Step 7:

The PCDB Administrator confirms that the workbook has been accepted and requests that a "SAP PCDB Application Declaration for Heat Network by Network Operator" form is signed by the Network Operator. This form confirms the accepted workbook (and revision date) and acceptance of the *"Terms and Conditions applicable to the listing of individual branded product performance data as an input to the National Calculation Methodologies for dwellings"*.

Step 8:

The PCDB Administrator defines a Network Index Number and Version Number for the heat network PCDB data record, e.g. Index Number: 210000, Version Number: 01.

The PCDB Administrator uploads heat network performance data to the PCDB. The PCDB is updated monthly on the last working day of each month, excluding December where uploads typically occur on the 24th.

⁴ This step is not applicable until further notice; data processing works required for applications will therefore not be chargeable.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 8 of 32

4. AMENDING DATA ENTRIES

4.1 Due to general heat network modification

It is recognised that heat networks may change over time, such changes must be reported by the Network Operator to the PCDB Administrator in accordance with the "PCDB data entry process for Heat Networks" defined above. Note: Step 4 may not apply and will be considered on an individual heat network basis with reference to actual heat network changes.

Changes to the heat network PCDB data record will result in the Version Number being incremented. Examples of heat network changes requiring PCDB Administrator notification and incremented Version Number include:

- Modification to heat network size⁵, e.g. when a new phase is added to a new build development
- Addition, removal or renewal⁶ of a heat generator, e.g. CHP, biomass boiler
- New energy demand and/or supply data becomes available, e.g. actual data to replace estimated data

The process for modifying a heat network PCDB data record is shown in Figure 1 below.

⁵ Where the heat consumption changes by +/- 10% as a result of dwellings and non-domestic buildings being added or removed from the heat network.

⁶ Where the renewal is not a like for like replacement

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 9 of 32

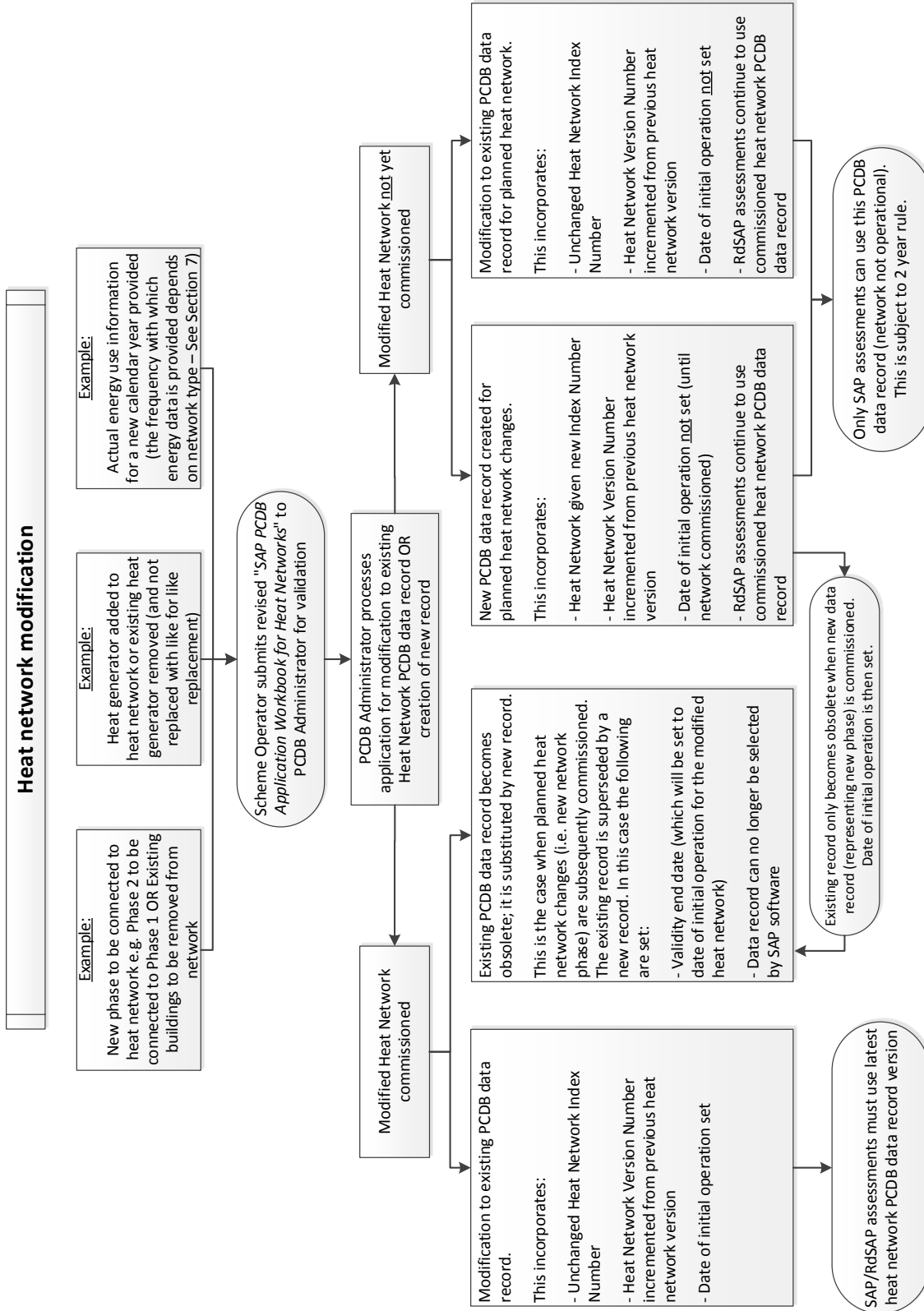


Figure 1 - Heat Network PCDB data record modification process

4.2 Due to new network construction phases

Heat networks, particularly those serving new residential developments, are often designed and built in multiple phases. Such phasing may extend over a long period of time, in some cases a decade or more.

SAP assessments are required at varying stages of a dwelling's life, specifically:

- To demonstrate compliance with Building Regulations at the 'as-designed' and 'as-built' stages (an Energy Performance Certificate (EPC) is produced at the as-built stage)
- To generate energy performance certificates (EPC) at lease or sale (and after the previous EPC has expired)

SAP will require heat network performance data at these stages. The PCDB is able to record this performance information for planned and existing heat networks.

SAP assessors may be required to undertake assessments for groups of planned dwellings, such as for Building Regulations compliance, where the planned dwellings (e.g. Phase 2 of a Heat Network) will be served through the extension of an existing heat network constructed to serve existing dwellings (e.g. Phase 1 of a Heat Network). In this case, the PCDB heat network data record must be based on the combined energy inputs and outputs for both the planned and existing dwellings. Figure 2 displays a range of possible Heat Network construction combinations. Figure 1 also defines the data record modification process for heat networks.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 11 of 32

	As-designed SAP assessment	As-built SAP (or RdSAP) assessment
Phase 1 of Heat Network construction	Use estimated data for Phase 1 'As designed' assessment	Use actual DH data for Phase 1 'As built' assessment (if available)
Phase 2 of Heat Network construction	Use estimated data for Phase 2 AND actual data for Phase 1 (where available) OR estimated	Use actual data for Phase 2 AND actual data for Phase 1 (if either available)
Phase 3 of Heat Network construction	Use estimated for Phase 3 AND actual for Phases 1 & 2 (if either available) OR estimated data for Phases	Use actual data for Phase 3 AND actual data for Phases 1 & 2 (if either available)

Figure 2 – Conducting SAP assessments for Heat Networks in different construction phases

It is recognised that, where a “low carbon” heat generator has been installed to serve Phase 1 and only boilers are proposed to serve Phase 2, the Phase 2 assessment will incorporate some of the CO₂ benefit originally accounted in Phase 1, affecting SAP assessment consistency. However, given the integrated and evolving nature of heat networks it is not considered practical to adopt a data entry process where specific “low carbon” heat generators are allocated to individual phases on the same heat network.

5. APPLICATION TECHNICAL GUIDANCE

Technical details must be entered in the “SAP PCDB Application Workbook for Heat Networks” and supplied to the PCDB Administrator in order to process a PCDB data entry or amendment. The applicant Network Operator must enter all required data in all worksheets of the workbook as below:

- Worksheet 1: ‘Background’ information
- Worksheet 2: ‘Heat supplied’ to customers
- Worksheet 3: ‘Energy Centre’ energy inputs and outputs
- Worksheet 4: ‘Heat generators’ description

Details must only be entered in the yellow cells.

The Network Operator must separately develop and maintain a workbook to monitor and assess the performance of their heat network. In particular, they must have produced monthly heat load profiles which illustrate:

1. Total heat consumption of dwellings and non-domestic buildings
2. Total heat supplied to the heat network by heat generators (see Figure A1 in Appendix 1)

The workbook is not intended to replace the Network Operator’s own monitoring and assessment methods. It is only intended to validate supplied performance information.

Note: All energy information must be provided on a gross calorific value (GCV) basis and relate to a single calendar year.

The sub-sections below provide further information on the specific requirements of the Worksheets.

5.1 Worksheet 1: Background information

The Network Operator must supply background heat network information for administration purposes, which includes:

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 13 of 32

- Heat network index number (only to be provided if heat network entered in PCDB previously)
- Previous version number (only to be provided if heat network entered in PCDB previously)
- Network name e.g. Trafford Estate Heat Network.
- Address of the primary energy centre
- Postcode of the primary energy centre
- Network Operator (applicant) details:
 - o Organisation name
 - o Contact person
 - o Contact person's telephone number
 - o Contact person's email address

The Network Operator (applicant) must provide evidence via a declaration that they are entitled to make representations on heat network performance on behalf of the owner.

The second element of the background information relates to the broad characteristics of the network and includes the following:

- A brief description of the network (maximum 255 characters). Where the network is serving multiple phases of a new build development, this must identify which phases are included and whether each phase is planned or existing.
- The length of the heat distribution network in metres, which is the trench length plus any internal distribution route within apartment block risers and laterals
- The date of initial operation, which is the date the energy centre(s) commenced supplying heat to all dwellings connected to that network phase. If the network phase is only planned then this field must be left blank.
- The network status, for example:
 - o Existing network
 - o Existing network plus planned new extension
 - o New network
- Network service provision: Whether the network will supply heat for
 - o Space heating and domestic hot water
 - o Domestic hot water only
 - o Space heating only

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 14 of 32

5.2 Worksheet 2: Heat supplied

An important aspect of the PCDB data entry process is determining the amount of heat supplied to the connected buildings. This is measured at the interface between the heat network and the building, i.e. the system boundary extends to the building connection, thereby enabling the effect of heat losses in the heat network to be accounted. Note: In the case of apartment blocks, it is the heat supplied to individual dwellings within the apartment block.

This worksheet requires that the Network Operator lists the connected buildings, or those to be connected, and provides an indication of each building's scale e.g. number of dwellings in each apartment block or floor area for each non-domestic building.

For each building the monthly heat supplied to dwellings and/or non-domestic buildings in each calendar month must be provided. Prior to providing the data for each building, the applicant is required to confirm:

1. Whether the building is existing, under construction or planned
2. Whether the building is already connected to the heat network or to be connected in future
3. Whether the data is based on meter readings or estimated

The user must state the calendar year to which the information relates, which must be the most recent full calendar year.

The information provided by the applicant will be used by the PCDB administrator to establish:

- Total number of dwellings including the total number of flats
- Total number of existing dwellings
- Total non-domestic floor area included

5.2.1 Heat supplied to dwellings and non-domestic buildings

Heat supplied to dwellings and non-domestic buildings must be metered and recorded. Ordinarily this will be used to provide actual metered heat consumption data for existing dwellings and non-domestic buildings within the PCDB data record. However, it is

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 15 of 32

recognised that in certain circumstances it may not be possible to provide 12 months of actual metered data at the point of application. It will therefore be permissible to submit estimated data as an interim measure.

Domestic

For apartment blocks, the monthly domestic heat supplied to the apartments within the block, expressed in MWh, must be entered into the worksheet. If applicable, the heat supplied to other types of dwelling, e.g. terraced houses, in each calendar month must also be determined and entered. In each case, the Network Operator must indicate if the monthly heat supplied figures are based on actual metered data or estimated. The worksheet automatically calculates the total domestic annual heat supplied.

Where meter reading data is not yet available, the Network Operator may estimate the heat consumption data for dwellings as an interim measure. SAP 2012, which uses local weather data to estimate space heating requirements, must be used to estimate the heat consumption of individual dwellings. Where dwellings are of the same type and characteristics, a modelled dwelling can be used to represent other dwellings. For example, a number of representative apartments could be used to estimate the heat consumption of all dwellings within an apartment block.

Non-domestic

As with dwellings, for each connected non-domestic building the heat supplied in each calendar month must be determined and entered. Non-domestic buildings, given their scale and commercial independence, invariably have individual heat meters. Therefore, it is expected that actual heat metered consumption will be provided for existing buildings served by existing networks.

Where actual metered data is not available, for example where a non-domestic building is under construction, the monthly heat consumption must be estimated based on modelling using SBEM⁷ or a dynamic building simulation tool certified to produce EPCs.

⁷ Simplified Building Energy Model, which is the UK National Calculation Methodology for energy rating of non-domestic buildings

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 16 of 32

These models provide space heating and hot water consumption on a kWh/m² basis, which can be used to derive the monthly MWh consumption figures required.

5.2.2 Correcting meter readings to calendar year

Meter reading data must relate to a whole calendar year. Where meter readings are not available for the entire calendar year corrections must be applied.

Additionally, it is important for January and December to ensure only heat consumed within the calendar year under consideration are included. Where necessary, a similar process must be adopted for other months. For example, where the opening heat meter readings were taken on 27 December of the preceding year and again on 31st January (a period of 35 days), the January (31 days) heat consumption figures would be adjusted accordingly, i.e. kWh / 35 *31.

5.3 Worksheet 3: Energy Centre

The energy centre worksheet requires the Network Operator to enter information relating to the energy inputs to and outputs from heat generators in the energy centre.

For each energy input and output, the user is required to indicate whether the figures are based on actual metered or estimated data. Where metered data is available this must be used. The worksheet includes provision for notes in relation to inputs within that row. Where elements of the fuel consumption data are estimated, the Network Operator will first determine the heat network's monthly heat energy requirement. This energy requirement will be the sum of total heat consumption of the dwellings and non-domestic buildings and heat losses from the network. Appendix 1 provides further information, whilst Appendix 2 provides guidance on the determination of distribution loss factors where data is estimated.

Apportioning combined gas consumption data

If, due to installed metering, gas consumption data is only available for the combined consumption of the energy centre, the gas consumption must be approximately apportioned to the different gas using heat generators, e.g. CHP, boilers. The heat

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 17 of 32

network's monthly heat load profile and the heat efficiency of the individual heat generators must be used to apportion the fuel.

5.3.1 Combined Heat and Power

For heat networks supplied with heat from a Combined Heat and Power plant (CHP), the Network Operator must enter:

- Monthly heat supplied to the network
- Monthly electricity generated
- Monthly fuel consumed in MWh
- Monthly volume of fuel consumed, unless energy use is estimated (see section 5.3.5 below on converting flow meter readings to energy)

In the case of operational CHP equipment, each of these parameters should be available from the monthly operating report provided by the CHP supplier – this is an automated report routinely produced by small-scale CHP suppliers.

For the avoidance of doubt, the monthly heat supplied is the useful heat supplied to the network, i.e. excluding any heat dumped in a heat rejection facility. For each energy input and output, the Network Operator must confirm that the figures are based on actual metered data.

Estimating data

Where actual CHP data is not available and estimates must be made, the text below provides guidance on how this must be approached.

Where CHP is proposed it will usually:

- be the lead heat generator,
- supply the majority of the heat required by the network, and
- operate on regular days and times throughout the year

The monthly heat supplied to the network from CHP must be estimated by accounting for hours run in each calendar month, heat output from CHP and any heat rejected (where applicable). Reference must be made to the monthly heat load profile generated from design calculations and the Network Operator's own predictions.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 18 of 32

The monthly electricity generated by the CHP must be specified. For CHP units with no heat rejection facility, the electricity output broadly equates to the monthly heat supplied to the network divided by the maximum heat to power ratio. For many CHP units with no heat rejection facility, the maximum heat to power ratio is provided in the Combined Heat & Power Quality Assurance (CHPQA) Programme (<https://www.gov.uk/combined-heat-power-quality-assurance-programme>) unit list⁸. Otherwise, the ratio must be obtained from the manufacturer's data sheet. For CHP units with a heat rejection facility, the heat to power ratio must be the heat efficiency (based on useful heat) divided by the power efficiency, which can vary according to operation.

The CHP fuel type and monthly fuel consumption must be specified. This will equate to the monthly heat supplied to the network by the CHP divided by the CHP heat efficiency. For CHP units with no integrated heat rejection facility, the heat efficiency for many CHP units is stated in the CHPQA unit list⁹. For CHP units with a heat rejection facility, the heat efficiency must account for the useful heat supplied to the network, i.e. any heat rejected must be subtracted from the CHP heat output. Note: If estimated energy use is provided it is not necessary to provide the volume of gas consumed.

5.3.2 Boilers

Where the heat network heat generator is a boiler or group of boilers using the same fuel, the Network Operator must enter:

- Overall heat efficiency
- Monthly fuel consumption in MWh
- Monthly volume of fuel consumed, unless energy use is estimated (see section 5.3.5 below on converting flow meter readings to energy)

The Network Operator must confirm whether figures are based on actual metered data. Where the heat efficiency varies throughout the year, the Network Operator may overwrite the calculated figures for monthly heat supplied to the network with actual

⁸ https://www.chpqa.com/guidance_notes/CHPQA_UNIT_LIST.pdf

⁹ https://www.chpqa.com/guidance_notes/CHPQA_UNIT_LIST.pdf

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 19 of 32

metered values. Cells which may be overwritten with data, if available, are coloured light blue.

Where solid fuel (e.g. biomass) is specified, the monthly fuel consumed must be determined with reference to the fuel characteristics. The mass of dry fuel must be determined by subtracting the element of the wet fuel's mass due to moisture. For example, for a moisture content of 30% by weight the wet fuel mass would be multiplied by 0.7, i.e. $(100 - 30)/100$. The dry fuel mass is then multiplied by the dry gross calorific value of the fuel to provide the energy input on a gross calorific value basis. The dry gross calorific value of the biomass must be obtained from the fuel supplier. The volume of solid fuel consumed must not be reported, but the mass of the fuel (on a dry and wet basis) and the calculations used to derive the energy content of the fuel must be provided (as an additional attachment).

Estimated data

The efficiency of the boiler(s) must be determined in accordance with Appendix C2 of SAP2012. The monthly fuel consumed must then be determined by dividing the total heat supplied to the network by the boiler(s), whether assumed or metered, by the boiler efficiency.

5.3.3 Other types

In low temperature heat networks, heat pumps are sometimes specified as the heat generator. The heat pump Seasonal Performance Factor (SPF) must be estimated by accounting for summer and winter operation as appropriate, multiplied by 100 (e.g. 200%) and entered into the heat efficiency cell. In this case the monthly fuel use to be entered is the heat pump electricity consumption. The worksheet automatically calculates the heat supplied by the heat pump.

In some cases geothermal heat is used as a heat source, e.g. hot water from deep geothermal wells is pumped to the surface and passed through a heat exchanger before the cooler water is returned to the ground. In this case, for the purposes of SAP, the heat efficiency must be entered as 100% and the monthly energy used by the heat source is assumed equal to the monthly heat supplied to the network by the heat source.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 20 of 32

Occasionally waste heat from power stations is used as a heat source, e.g. heat is extracted from a large steam turbine power station and passed through a heat exchanger supplying a district heating network. In this case, for the purposes of SAP, the heat efficiency must be entered as 100% and the monthly energy used by the heat generator is assumed to be equal to the monthly heat supplied to the network by the heat source. Within the workbook the carbon intensity and primary energy factors in Table 12 of SAP 2012 for waste heat from power stations are automatically applied to the monthly heat supplied.

5.3.4 Electricity used by circulation pumps

Heat networks use pumps to circulate primary water through distribution pipes and supply heat energy to dwellings and non-domestic buildings. The electrical energy consumption of these pumps must be recorded in Worksheet 3.

Where circulation pumps are sub-metered the actual metered consumption must be provided. Where metered data is not available, the electricity consumption must be estimated by accounting for the characteristics of the pump(s) e.g. rated power, operating hours, etc.

For the avoidance of doubt, this electricity consumption does not include that used by circulation pumps within dwellings and non-domestic buildings.

5.3.5 Converting flow meter readings to energy

Heat and electricity meters will normally provide readings in kWh or MWh, however, gas meters will usually provide the volume of gas consumed. This volume must be corrected for actual temperature and pressure then converted to energy using the calorific value of the gas. The assumptions used for calculation of energy from gas consumed must be provided.

Similarly meters recording the liquid fuel used by a heat generator will normally report in litres. This value must be converted to MWh using the calorific value of the liquid fuel.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 21 of 32

5.4 Worksheet 4: Heat generators in the energy centre(s)

Worksheet 4 requests information on the fuel, type and capacities of the heat generators located in the energy centre. Information must be provided on all heat generators used to generate heat for the network, i.e. the system boundary encompasses the whole heat generation system, not individual heat generators.

Information must be provided for each heat generator. The information required includes:

- Type of fuel as classified in table 12 of SAP 2012 e.g. mains gas, oil, biomass, etc.
- A description of the type of heat generator, e.g.
 - o Spark ignition reciprocating engine CHP
 - o Gas turbine CHP
 - o Boiler
- Where the heat generator is CHP, whether or not a heat rejection facility is present
- Heat generator manufacturer
- Year heat generator was commissioned
- Total Heat Output Capacity – expressed in megawatts (MW)
- Total Electricity Output Capacity (if applicable) – expressed in megawatts (MW) at ISO¹⁰ conditions

If CHP is a heat generator, the applicant must confirm whether or not the CHP has a dedicated heat rejection facility, i.e. heat dump. For a reciprocating engine this is often achieved via air cooled condensers and for a gas turbine CHP this is often achieved via an exhaust gas heat exchanger bypass.

¹⁰ International Organization for Standardization

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 22 of 32

6. DATA PROCESSING FOR PCDB DATA ENTRY

The purpose of the PCDB Administrator processing data supplied by the Network Operator in the “SAP PCDB Application Workbook for Heat Networks” is to validate the following parameters for data entry in the PCDB:

- Distribution loss factor
- Pumping electrical energy
- Heat generator type(s)
- Heat generator fuel for each generator
- Heat efficiency for each heat generator
- Heat Fraction for each heat generator
- Electrical efficiency for Combined Heat & Power unit(s) (if applicable)
- Heat Fraction for Combined Heat & Power unit(s) (if applicable)

A number of other parameters are also recorded in the PCDB, see “APPENDIX 3 - PCDB HEAT NETWORK DATA FORMAT”.

Using the methodology defined in the SAP 2012 specification, the validated performance characteristics of the heat network will be used to establish the following for heat supplied to connected dwellings and non-domestic buildings:

- Carbon dioxide emission factor
- Primary energy factor

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 23 of 32

7. PCDB RECORD MAINTENANCE REQUIREMENTS

An application for entry of Heat Network performance data in the PCDB may initially be based entirely or partially on estimated data supplied by the Network Operator. It will be necessary to provide actual metered heat consumption data within two years of the heat network commissioning date in order to maintain the PCDB data entry. If this is not supplied the PCDB data record validity end date will be set at the second anniversary of the data entry. From this date SAP assessments using the PCDB record will no longer be possible and default data will be required, if available.

Note: Each dwelling and non-domestic building (and any other system consuming heat supplied by the heat network) must have an individual heat meter fitted. To determine the performance characteristics of a heat network it is essential that the amount of heat supplied to dwellings and non-domestic buildings is measured.

7.1 Frequency of data provision

Upon receipt of the “SAP PCDB Application Workbook for Heat Networks” from the Network Operator the PCDB Administrator will review and process the application and may request further details/data and any necessary workbook revision iterations. Once the workbook is accepted by the PCDB Administrator, a validity period for the data record will be applied. This depends on a number of factors influencing the seasonal performance of the heat network.

For example, the environmental performance of a small heat network supplying dwellings from a central gas boiler is unlikely to change significantly from year to year. In comparison, a large multi user heat network connected to a range of heat generator types may vary considerably, with factors such as relative fuel costs influencing operation.

Table 1 defines the validity period for Heat Network PCDB data entries, this includes metered systems where heat supply, fuel consumption and, where applicable, electricity generation data is provided.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 24 of 32

	Type	Validity period
1	Heat network only connected to 1 heat generator, e.g. central boiler(s) using same fuel. Data record based on metered data.	7 years
2	Heat network connected to 2 heat generators, e.g. CHP and top-up boilers OR biomass boiler and gas boilers. Data record based on metered data.	3 years
3	Heat network connected to 3 or more heat generators, e.g. municipal waste CHP, gas boilers and oil boilers. Data record based on metered data.	2 years
4	Heat network data record based on design data (and subject to in-use factor).	2 years

Table 1 – Data record validity period for heat networks in PCDB

8. AUDITING

Heat networks listed in the PCDB will be subject to random technical audit at any time, subject to three weeks' notice being given by the PCDB Administrator, see: *“Terms and Conditions applicable to the listing of individual branded product performance data as an input to the National Calculation Methodologies for dwellings”* at: www.ncm-pcdb.org.uk/sap. This will include site visits to ensure data submitted by the Network Operator corresponds with the actual network.

During the desk-based element of the audit the Network Operator will be required to:

- Confirm the heat generators connected to the heat network and the details relating to:
 - o Heat generator type
 - o Fuel used by each heat generator
 - o Heat and, where applicable, electrical power output capacity
- Confirm the metering is in place to monitor the fuel inputs and heat and electrical outputs from heat generators connected to the heat network. For each meter the following will be confirmed:
 - o Metered service, e.g. natural gas, heat, electricity
 - o Description of the metered service: examples of this include:
 - Natural gas supply to the energy centre
 - Natural gas supply to the top up boilers
 - Natural gas supply to the CHP
 - Total heat supplied to the heat network
 - Total heat supplied by CHP
 - Electricity generated by the CHP
 - o Year of meter installation
 - o Model/type of metering
 - o Serial number of the meter
 - o Measurement units of the meter e.g. m³, MWh.
 - o Date of calibration from the calibration certificate
- Provide a diagram showing the metering arrangements in relation to the heat generator(s)
- Confirm the heat metering method in the dwellings and non-domestic buildings

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 26 of 32

- Explain how the energy input and output data provided in the final revision of the “SAP PCDB Application Workbook for Heat Networks”, accepted by PCDB Administrator, was derived from meter readings

During the site visit the audit will confirm the connection of heat generators and fuel type, and also consider any issues arising from the desk based element of the audit, e.g. the configuration and operation of any heat rejection equipment connected to the CHP.

Applicants must maintain clear and accurate records that support their Heat Network PCDB data record. Therefore, it is essential that appropriate metering is installed and monitored.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 27 of 32

APPENDIX 1: MONTHLY HEAT SUPPLY TO NETWORK PROFILE

The total heat to be supplied to the heat network by the heat generators must be determined by multiplying the heat supplied to customers by the distribution loss factor.

To determine the distribution loss factor it is necessary to determine heat lost from the network over a calendar year - see Appendix C3.1 of SAP2012 for further details. This loss is added to the total heat supplied to connected dwellings and non-domestic buildings and the resulting sum divided by the total heat supplied to connected dwellings and non-domestic buildings.

If the Network Operator is providing estimated data, a monthly heat load profile must be generated. The heat profile must show the heat supplied to the network in each month from all heat generators combined. Additionally, making use of colour coding, the estimated heat to be supplied by each heat generator for each month must be clearly shown. An example of such a monthly heat profile is shown in Figure 3 below.

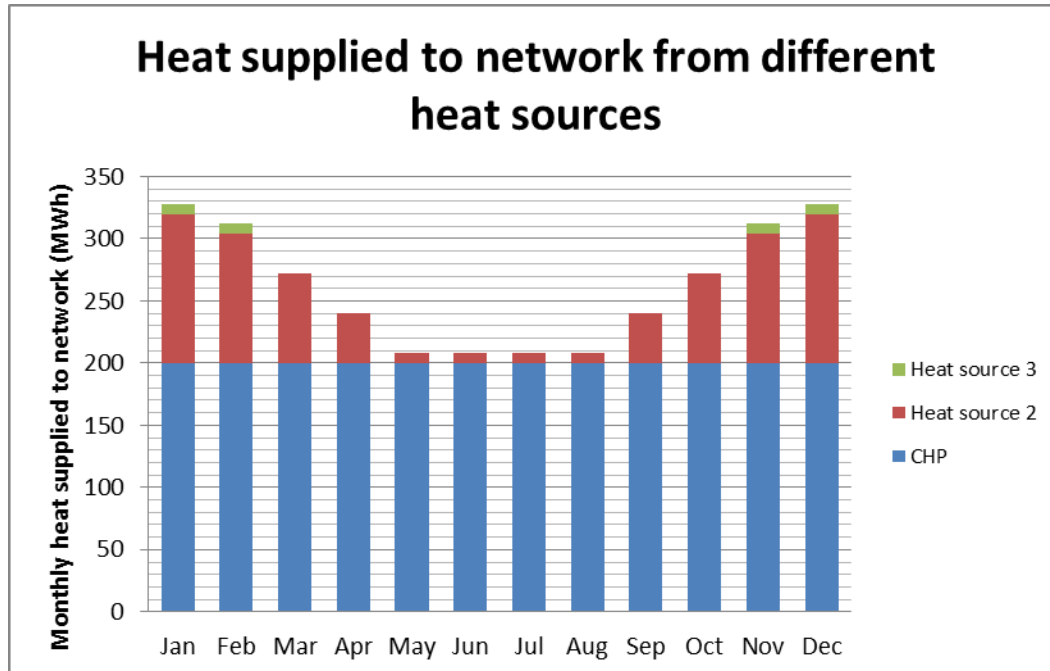


Figure 3: Example profile showing monthly heat supplied to the network

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 28 of 32

APPENDIX 2 – DISTRIBUTION LOSS FACTOR CONSTRAINTS

Entry of data into the yellow cells of the workbook will result in figures being generated for:

1. Total monthly heat consumption of dwellings and non-domestic buildings
2. Total monthly heat supplied to the network by the heat generators (see Appendix 1 Figure A1)

The workbook uses these values to determine the monthly and annual distribution loss factors.

Where data is estimated, the PCDB Administrator will examine the distribution loss factor generated by the workbook to check it does not overestimate performance when considering heat network characteristics. Where the distribution loss factor is considered unrealistically low by the PCDB Administrator the detailed design assumptions and calculations relating to heat loss will be requested from the applicant. This will include the following:

- Pipe diameter (mm)
- Pipe length for each diameter (m)
- Thermal conductivity of pipe insulation (W/m K)
- Pipe insulation thickness (mm)
- Design flow and return temperatures (°C)
- Average temperature of pipe location (°C), e.g. ground or air

Accounting for the above, the heat loss per metre of pipework must be provided for each pipe diameter that is specified. The total heat loss rate and annual heat loss must also be provided, see Table 2 below.

Issue: 1.1	Application guide for entry of heat network performance data in SAP Products Characteristics Database	APPF:01
Date: 26/05/2016		Page 29 of 32

Pipe Diameter (mm)	Total length of pipe (m)	Heat loss per metre of pipe (W/m)	Total heat loss for pipe (W)	Annual heat loss from pipe (kWh)
TOTAL		N/A		

Table 2 - Heat loss from heat network

The PCDB administrator will use this information to determine if the distribution loss factor can be validated. Where the factor can't be validated, the applicant will be notified and requested to address specific issues and provide an updated "SAP PCDB Application Workbook for Heat Networks". An in-use factor may be applied to account for in-use performance.

APPENDIX 3 - PCDB HEAT NETWORK DATA FORMAT

FORMAT 601 (for Community Heat Networks Table)			
Field	X	Field name	Description
1		Community heat network index number (digits)	Unique index number for each network, assigned automatically by database software and used for control and reference purposes. (See 7.1).
2	X	Community heat network version number (2 digits)	Network version for the network identified in field 1. It is numbered from 1 upwards and incremented if the network is extended and when equipment data is amended (for example a change to a heat generator) or if the energy use information is updated.
3		DB entry updated (yyyy/mmm/dd hh:mm)	Date and time this record was created or last amended by the database administrator.
4		Description of network (up to 255 chs)	A short description identifying the dwellings to which the network version applies. Where the network is constructed in phases this may also indicate which phases are connected.
5	X	Validity end date (yyyy/mmm/dd)	The last day of validity of this data record. Dwellings assessed after this date use a data record with a higher network version number (in the case of new dwellings the applicable assessment date is that of the as-designed assessment). Blank if there is no record with a higher network version number.
6		Community heat network name (up to 50 chs.)	The name by which the community heat network is known.
7		Postcode of the Primary Energy Centre (up to 8 chs)	The postcode of the energy centre providing heat for the network. Where there is more than one energy centre, it is the postcode for the energy centre supplying the largest amount of heat.
8		Locality (up to 35 chs.)	The locality in which the community heat network is situated. May be blank.
9		Town name (up to 30 chs.)	The post town nearest to the community heat network.
10		Administrative area (up to 30 chs.)	The administrative area in which the community heat network is situated. May be blank.
11		Date of initial operation (yyyy/mmm/dd)	The date on which the energy centre was commissioned (or re-commissioned if the network is extended) to serve all dwellings included in the assessment. Blank if it is not yet operational or if the assessment includes dwellings not yet connected.
12		Total number of dwellings included (up to 5 digits)	The total number of dwellings included in the assessment of the heat network.
13		Number of flats (up to 5 digits)	The number of flats included in the assessment of the heat network.
14		Non-domestic floor area connected (up to 6 digits)	The floor area of any non-domestic buildings connected to the heat network.
15		Total number of existing dwellings (up to 5 digits)	The number of dwellings which have been constructed. This can be less than the number in field 12 if the assessment included dwellings not yet constructed.
16	X	Service provision (1 digit)	Service provision, encoded as: 1 space and water heating; 3 space heating only; 4 water heating only. If a network has separate systems for space heating and water heating, there will be a record for each.
17	X	Provisional or actual data (1 digit)	Whether the record represents provisional (estimated) data or actual recorded data, encoded as 1 or 2 respectively. Provisional data may be assigned to new networks for which recorded data are not yet available.
18	X	Year (4 digits)	The calendar year to which the data relates. Blank if provisional data.
19		Heat metering on supply to network (1 digit)	Whether the heat supplied to the network from the energy centre is metered. 1 for yes, 0 for no.
20		Total MWh of heat per annum supplied to network (up to 6 digits)	The annual amount of heat supplied to the network by the plant in the energy centre.
21		Total MWh of heat per annum delivered to customers (up to 6 digits)	The annual amount of heat delivered to all customers (dwellings and non-domestic), thereby indicating the scale of the network.
22		Individual dwelling heat metering (1 digit)	Whether the supply of heat to each individual dwelling is metered. 1 for yes, 0 for no.

23		Total MWh of heat per annum delivered to dwellings (up to 6 digits)	The annual amount of heat delivered to dwellings.
24		Distribution route length in metres (up to 6 digits)	The total length of the network heat distribution pipework route. In the case of underground pipework it is the total trench length containing pipework plus any internal distribution route within apartment block risers and laterals. It includes both flow and return water pipes i.e. it is not the sum of the flow and return pipework.
25		Linear loss (up to 7 digits eg xxx.xxx)	The average heat loss per metre length of network heat distribution pipework route in W/m.
26	X	Distribution loss factor (up to 4 chs, e.g. x.xx)	Factor that allows for losses from the heat distribution network, see SAP section C3. Applicable to all connected premises.
27		Pumping electrical energy (up to 6 digits, e.g. xxxxxx)	Annual electrical energy for pumping in the heat distribution network in kWh/year.
28	X	Pumping electrical energy per dwelling (up to 6 digits, e.g. xxxx.xx)	Annual electrical energy for pumping in the heat distribution network attributed to each dwelling, in kWh/year.
29		Carbon dioxide intensity of heat (up to 6 digits e.g. xx.xxx)	The average carbon dioxide intensity of the heat delivered to customers. in kg/kWh. This value takes into account all factors which influence the emissions associated with the heat supplied. It is based on the heat delivered to individual dwellings, and to the building in the case of non-domestic premises.
30		Primary energy factor of heat up to 5 digits e.g. xx.xx)	The average primary energy factor of the heat delivered to customers. This value takes into account all factors which influence the primary energy associated with the heat supplied. It is based on the heat delivered to individual dwellings, and to the building in the case of non-domestic premises.
31	X	Number of heat sources (1 digit)	Number of separate heat sources (between 1 and 5). Heat sources are considered separate if they differ in heat source type or fuel, e.g. a set of boilers each using the same fuel are treated as one source with efficiency as defined in C2 of the SAP specification.
32	X	A: Heat source type (1 digit)	Group A: Type of heat generator, encoded as 1: CHP; 2: boilers; 3: heat pump; 4: waste heat from power station; 5: geothermal. If CHP is part of the installation it is given as Group A.
33	X	A: Community fuel (2 digits)	Group A: The community fuel to which the data relates, either one of community fuel codes in SAP Table 12, or 99 in the case of a fuel not in SAP Table 12.
34	X	A: Fuel description (up to 30 chs)	Group A: Description of the fuel in the preceding field. May be blank if field 33 is not 99.
35	X	A: Heat efficiency (up to 4 digits, e.g. xx.x)	Group A: Heat efficiency of heat source in % gross.
36	X	A: Power efficiency (up to 4 digits, e.g. xx.x)	Group A: Power efficiency of CHP plant in % gross. Blank if not applicable.
37	X	A: Heat fraction (up to 5 digits, e.g. x.xxx)	Group A: The fraction of heat supplied by the community heat network attributable to the heat source.
38	X	A: Community fuel CO ₂ emission factor (up to 5 chs, e.g. xxx.x)	Group A: The CO ₂ emission factor in kg/kWh for the fuel. Blank when field 33 is not 99.
39	X	A: Community fuel primary energy factor (up to 4 chs, e.g. x.xx)	Group A: The primary energy factor for the fuel (dimensionless). Blank when field 33 is not 99.
40 to 31+8n	X	Group B, C, D, E	Group B, C, D, E. Set of data in the same format as those for group A for other heat sources. n is the value in field 31.