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GOOD PRACTICE GUIDE 240

Community heating

– a guide for housing professionals

Combined Heat & Power Association
energy efficiency for a better environment

LOCAL AGENDA 21 UK

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CONTENTS

1 INTRODUCTION

A community heating (CH) scheme is defined as 'where more than one building or dwelling is heated from a central source'. For the purposes of this Guide such schemes typically comprise:

- a sheltered housing scheme heated by a simple gas-fired boiler plant
- housing estates of several hundred homes supplied with heat from central plant consisting of boilers and/or combined heat and power (CHP)
- city-wide heat distribution networks fed from, for example, large CHP/energy from waste (EfW) plants.

Schools, leisure centres, shopping malls, offices, factories, etc are often included in CH schemes, thereby increasing the load diversity.

This Guide is written for housing managers, technical services and maintenance staff within local government or housing associations. It is intended to provide an understanding of the housing management and economic issues associated with CH, so that these issues can be considered at the conceptual and development stages of refurbishment and regeneration schemes. More detailed guidance on technical and financial issues is provided in Good Practice Guide 234 'Guide to community heating and CHP'. This Guide also contains information relating to legal, insurance and environmental issues.

Details of suggested further reading and a list of organisations offering information and advice are included on page 18.

2 WHY COMMUNITY HEATING?

2.1 THE BACKGROUND

CH is a clean, efficient and reliable form of heating that can be delivered at an affordable cost to householders and other users. CH is not new, having been used in the UK and other European countries for over thirty years. In the EU, 22 million people (6% of the population) have their homes, offices or factories heated by CH (see table 1).

UK CH schemes developed in the 1960s were justifiably criticised for being uncontrollable and unreliable. These schemes suffered because designers were inexperienced, and system components were at an early stage of development. Frequently, CH schemes were installed with inadequate end-user controls resulting in excessive energy usage, poorly designed heat distribution systems that were unable to deliver heat consistently to all users, and heat mains that were subject to premature failure making the systems unreliable. Furthermore, inadequate site supervision led to poor quality of installation.

In addition, many 1960s' schemes did not provide whole-house heating.

Country	CH proportion of domestic heating market (%)
Denmark	40
Finland	44
Netherlands	3
Germany	9
UK	< 2

Table 1 CH schemes as a proportion of the domestic heating market

Modern CH schemes benefit from the research carried out to address these shortcomings, and CH technology is now mature. For example:

- end-user controls are similar to those for individual heating systems
- heat distribution problems have been overcome
- buried heat mains are factory-insulated and include fault detection systems
- the importance of high quality in installation practices is recognised by contractors

- long-term (10-15 year) maintenance and warranties are available from equipment suppliers
- electronic heat meters with a prepayment facility are available.

2.2 HOUSEHOLDER BENEFITS

The principal benefits of CH for the householder are linked to affordability, offering a genuine and tangible incentive to join a CH scheme.

- *Affordability*. The benefits of bulk fuel purchase and the higher efficiency of larger heat production plant can be passed on through lower heat charges. Affordable warmth brings the benefits of improved standards of comfort, which in turn leads to a reduction in the incidence of cold-related illnesses such as hypothermia and respiratory disorders, such as asthma.
- *Controllability*. Individual room temperature control and programmable heating and hot water on/off times are available as standard features of modern CH systems. It is also possible to design systems which can deliver specified levels of heating to properties.
- *Abundant hot water*. Domestic hot water storage cylinders with fast recovery times can be designed into CH systems or, alternatively, a compact plate heat exchanger providing instantaneous hot water can be installed in place of a cylinder. This has the added benefit of releasing storage space for use by the resident.
- *Metered heat*. Modern metering can ensure that residents pay only for what they use, and prepayment facilities can be provided.
- *Low-cost electricity*. CH schemes can be supplied from CHP units. The electricity generated by these units can be sold directly to residents, offering the possibility of cheaper power as well as affordable warmth. Alternatively, the electricity can be sold or used in public buildings owned by local authorities.

2.3 LANDLORD BENEFITS

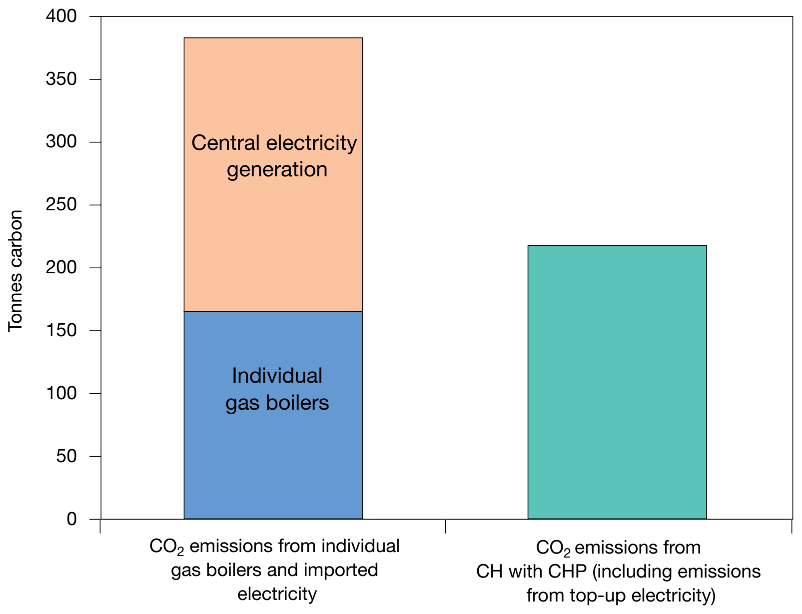
The benefits to the landlord are a direct result of the affordability of heat to tenants.

- *Lower maintenance costs*. Where tenants can afford a reasonable level of heating, the risk of damp, mould growth and condensation are greatly reduced, resulting in lower maintenance costs. The cost of annual servicing required for individual domestic boilers is also eliminated.
- *Lower management costs*. Warm homes make for happy tenants. Homes that can be affordably heated will have:
  – reduced rent arrears
  – lower void rates
  – fewer changes in tenancy.
- *Increased rents*. Homes with full heating can attract higher rents.
- *Life-cycle cost*. Over its lifetime, the cost of a CH system is significantly less than the alternatives.

2.4 ENVIRONMENTAL BENEFITS

The greater efficiency of CH means that associated carbon emissions are less than those resulting from using individual boilers. Where CHP is the heat source for CH the reduction of carbon emissions is far greater. See section 4 on CHP.

Figure 1 Carbon dioxide (CO_2) emissions (expressed as tonnes of carbon) for a 350-dwelling scheme comparing CHP/CH with individual boilers and imported electricity



3 DESIGN AND OPERATION OF MODERN COMMUNITY HEATING

3.1 INTRODUCTION

The physical elements of a CH system are a central heat source and a heat distribution system connecting it to the end-user installations inside each dwelling. The cost of providing the heat is recovered through a heat charge made to the householders, which may be a fixed service charge or a tariff related to the amount of heat used. Modern control systems and planned maintenance help to ensure that the system is reliable.

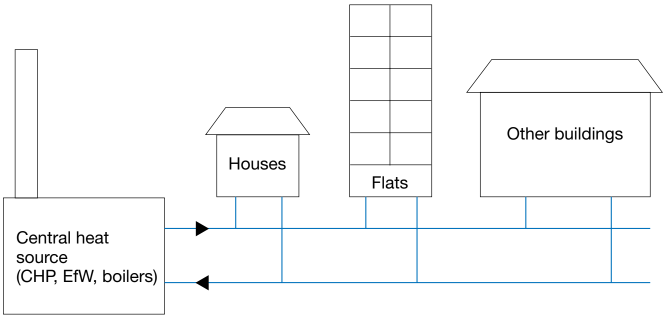


Figure 2 Schematic diagram of community heating

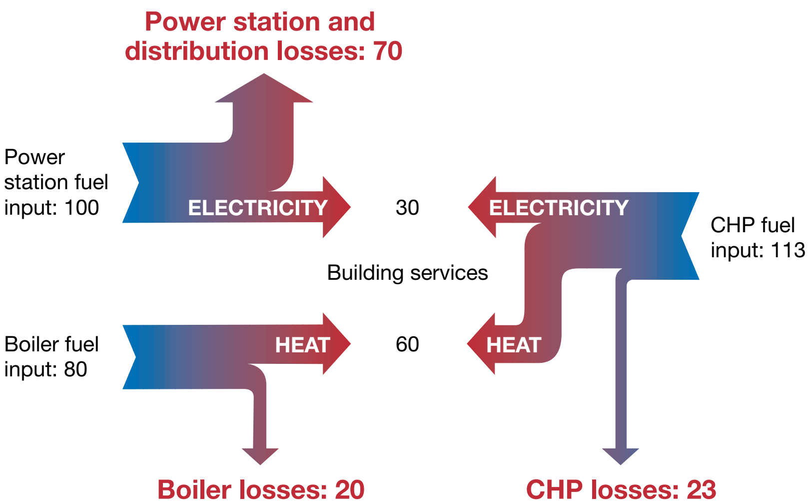


Figure 3 Energy flow diagram. CHP uses the heat that is usually wasted when electricity is generated from fossil fuels. Existing CH systems provide a ready-made heat load for CHP

3.2 HEAT SOURCES

CH provides a means of using energy sources and energy conversion techniques that are not available or applicable to individual heating systems. CH schemes can utilise the energy in waste, waste heat from industrial processes, and even geothermal energy, and can use conventional fuels at very high efficiency by burning them in large boilers or CHP plant.

3.2.1 Combined heat and power

When electricity is generated using fossil fuels most of the energy in the fuel is lost as waste heat. CHP systems recover this waste heat which can be used for CH in conjunction with centralised boilers. CHP thereby utilises fuel very efficiently, minimising the environmental impact and leading to very low heat production costs. CHP is discussed in detail later in section 4.

3.2.2 Boilers

Modern high-efficiency boilers burning gas or oil operate at efficiencies of 80-85%. To ensure reliable heat supplies, more than one boiler should be installed. Very highly efficient condensing boilers are also available. The higher efficiency of 90% which these boilers offer is achieved by capturing the heat available in the water vapour contained in the boiler exhaust gases. To do this, the boiler will be fitted with an additional heat exchanger. To achieve condensing efficiencies, the heating system needs to be designed to provide a low return water temperature to the boiler, ie below 55°C.

3.2.3 Energy from waste

Municipal solid waste (MSW) is widely used in Europe as a fuel for heat and power production. Two examples in the UK are Sheffield and Nottingham, which have city-wide CH networks supplied with heat from EfW plants that also generate electricity.

The development of EfW plant has been stimulated through the government's Non Fossil Fuel Obligation (NFFO) which offers premium price electricity contracts to companies which develop EfW CHP plants.

DESIGN AND OPERATION OF MODERN COMMUNITY HEATING

The development of heat supply networks associated with waste incineration facilities is an opportunity for housing managers to meet the heating needs of their premises from a renewable energy source. Modern incinerators are equipped with flue-gas clean-up equipment that complies with stringent emissions legislation. Several Good Practice Case Studies illustrate the practical application of this concept (see GPCS 81, 82, 312, 313, 314). Details are shown on page 18.

3.2.4 Energy linking

Where there is no CH scheme, there may be opportunities for energy linking. Energy linking is the utilisation of existing boiler plant or other heat sources on adjacent sites. This has a number of important advantages:

- different buildings have different patterns of energy consumption – this means that linking the buildings will utilise the plant more fully
- greater overall efficiency of plant operation
- avoiding duplication of plant leads to reduced capital cost, reduced maintenance cost and saving of space
- energy linking of buildings can be an ongoing process – buildings which have been linked may form the nucleus of a new CH network.

3.3 HEAT DISTRIBUTION

The principal difference between individual heating systems and CH is that heat, in the form of hot water, is distributed from a central source to a number of users. The type of distribution system will depend on the type of scheme.

- On a small scheme serving a block of sheltered flats, heat will be distributed by conventional pipes insulated in situ.
- For larger schemes, where a number of buildings are connected to the network, it is usual to install specially designed preinsulated pipes (known as heat mains (see figure 4)) that are normally buried in the ground in a similar way to gas or water mains or electricity supply cables.

3.3.1 Heat mains

Design of pre-insulated heat mains has been continually developing since their introduction in the 1950s, and it is now also covered by European standards (see page 18). The piping systems are very reliable, with service lives in excess of 30 years, and are produced by a relatively small number of specialist manufacturers. Heat mains are available with integral alarms to detect water leaking into the insulation, which would otherwise lead to corrosion. Piping systems are manufactured in accordance with quality assurance procedures complying with ISO 9000, 9001 and 9002, and with European standards EN253, 448, 488 and 489.

The design of the heat distribution network is fundamental to the economic viability of CH, because it has a major impact on the capital and running costs. Network design influences costs in the following ways.

- *Installation costs*. A substantial proportion of the cost per metre of pipe laid is for digging and back-filling the trench and reinstatement. Costs can be minimised by selecting mains routes that avoid expensive reinstatement and by optimising the design of the network to ensure that pipes are not oversized, but are of sufficient size to meet future demands.
- *Running costs*. The two main factors that affect running costs are heat losses from the distribution system and energy for pumping water around the network. Pipe heat losses can be reduced by selecting a low flow temperature (below 90°C) and low return temperature (preferably below 50°C). Pumping energy costs can be reduced by designing the network with a large difference between flow and return temperatures and utilising variable speed pumping.

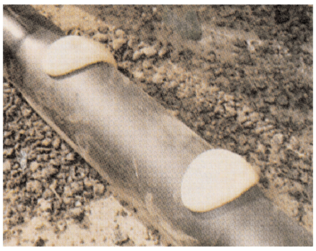
3.4 END-USER INSTALLATIONS

To the end-user (householder or other building user) the components of the CH system will be indistinguishable from a conventional individual gas-fired heating system. The CH system will have radiators, pipework, a hot water storage cylinder (or instantaneous heat exchanger), thermostatic controls, and time control as required. This can be an important consideration for the housing manager who has responsibility for introducing tenants to the idea of CH. The only significant difference is that there will be a 'consumer interface unit' (CIU) instead of a boiler. Other benefits for the householder include: less noise, no gas combustion in the home, and no flue, making this a safer means of heating than individual boilers. Generally, a CH installation will also take up less space than a conventional central heating boiler.

Connecting leak detection cables

Pressure testing the protective sleeve

Filling with expanding foam insulation



Confirming a fully insulated joint

Figure 4 Heat mains installation

DESIGN AND OPERATION OF MODERN COMMUNITY HEATING

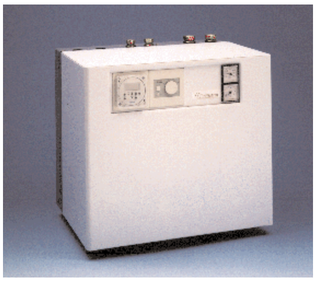


Figure 5 Photograph of CIU. This modern CIU replaces the boiler and is the same size as a conventional boiler

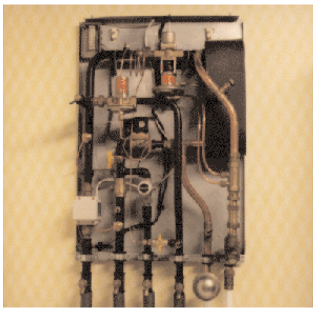


Figure 6 The inside of the CIU showing the small domestic hot water plate heat exchanger, top, which replaces the boiler

3.4.1 Consumer interface unit

The CIU will contain the incoming and outgoing heat mains, control valves and metering (if required). Pipes are run from the unit to feed the radiators and the hot water cylinder. The unit should be provided with a robust removable cover which can be sealed to prevent tampering (see figure 5 for a typical example). The units are similar in size and appearance to wall-hung boilers. However, unlike a boiler which must usually be located close to an external wall for ease of flueing, the unit can be located in a convenient location such as an internal cupboard.

3.4.2 Domestic hot water

In a similar way to an individual gas-fired heating system, CH can provide hot water either via an indirect storage cylinder or instantaneously in a similar way to a combination boiler. This is particularly useful in small properties where space for a cylinder is limited. In larger properties the use of combination boilers can give rise to complaints about a lack of adequate hot water at times when more than one tap is in use. This is not the case with CH, because the heat exchanger in the CIU can be easily designed to provide a higher flow of hot water to meet the requirements of the property.

3.4.3 Heating controls

Lack of control of temperature or timing of heat use has been a frequent past criticism of CH. Today's systems can have the controllability of individual gas heating: room temperature control (thermostatic radiator valves and room thermostats), control of hot water temperature (cylinder thermostat) and timed on/off control of heating and/or hot water, giving the end-user full control over their heating and hot water system.

3.5 CHARGING FOR HEAT

There are two ways for end-users to pay for their heat – through the service charge, or by a meter.

The **service charge** is calculated using some measure of property size (eg floor area, number of heated rooms), and the charge may be made on a monthly or weekly basis and included with the rent (heat-with-rent). The charge is not related to actual consumption but to the provision of a

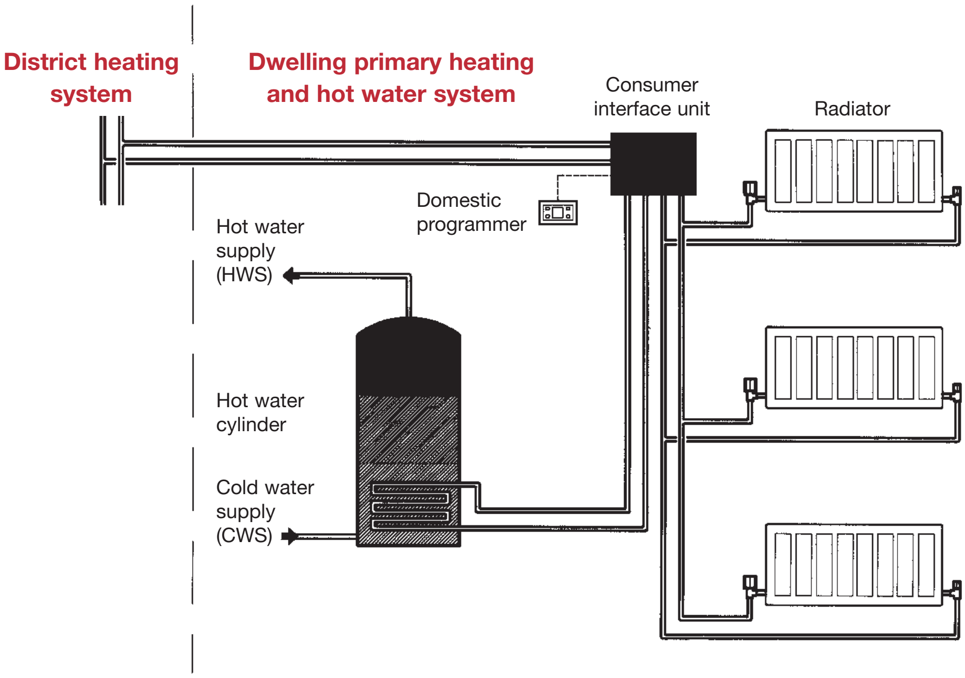


Figure 7 Diagram of heating system. The hot water and heating system within the dwelling is fully controllable and differs from a conventional gas-fired system only by the use of the CIU instead of a boiler

DESIGN AND OPERATION OF MODERN COMMUNITY HEATING

heating service. This can be a cause of concern to residents, particularly relatively low energy users, who may feel that they are subsidising larger energy users. On the other hand, the service charge approach avoids penalising those who have to spend more time at home and occupants of dwellings which need more heat (eg top floor flats). When the charges are set, the anticipated fuel use of the CH system will have to be estimated so that a reconciliation can be made at the end of the year once the actual costs are known. Heating of communal areas may also be recovered through a service charge. However, a service charge for unmetered energy will remove an important incentive for tenants to save energy.

Meters are available which can directly measure the quantity of heat consumed by an individual dwelling. The metering system measures the flow of heating water and the temperature difference between the water entering the property and the water leaving, and calculates the heat taken. This is registered on the meter as a consumption in kilowatt-hours (kWh). Customers are charged for the heat they consume at a p/kWh rate. Where heat is metered, prepayment devices can be installed, reducing the costs of administering the heat metering system and avoiding the risk of bad debt.

The fixed costs of the CH system are the capital repayments, maintenance, administration, etc. The variable cost of the heat supplied may be the fuel costs for a boiler or CHP plant, or a bulk heat purchase from an EfW plant. Where heat is metered, the unit rate should reflect the variable fuel cost, and fixed costs should be recovered through a standing charge or rent, thus minimising the risk of a shortfall in income recovery. If the unit rate is set at a level which recovers all costs, the resulting relatively high heat price may unnecessarily constrain demand, with the result that costs are not fully recovered.

Figure 8 Modern metering systems are very reliable. Administration costs and the risk of non-payment can be minimised through the use of prepayment meters

3.6 MANAGEMENT AND MAINTENANCE

Reliability and consistent efficiency is dependent on good management of the operation and maintenance of the CH system. Good quality maintenance can be achieved by selecting a contractor with a good understanding of CH systems and by ensuring an effective handover from the construction contractor. It is also important that the scheme owner clearly specifies their needs in respect of response times to call-outs and reporting on system performance.

The communal plant (CHP or boilers) will generally be unmanned and operate automatically, though regular visits should be made. It is usual for the operation and maintenance of the plant to be contracted out under a maintenance agreement, including preventative maintenance visits and guaranteed response times for call-outs. Use can be made of a building energy management system (BEMS) to alert the contractor via a modem link to fault conditions.

DESIGN AND OPERATION OF MODERN COMMUNITY HEATING

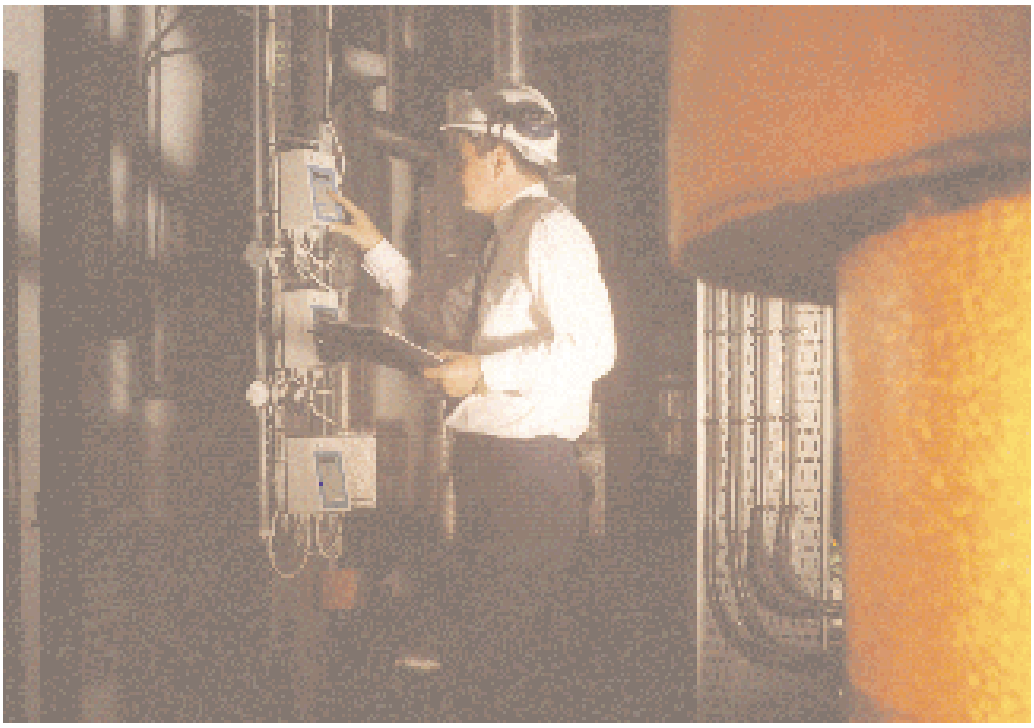


Figure 9 Good-quality maintenance can be achieved by selecting a contractor with a good understanding of CH systems

Pre-insulated heat mains are proprietary systems that should be installed, commissioned and maintained by a specialist supplier. With appropriate maintenance, a service life of more than 30 years is possible. To guard against unexpected maintenance expenditure in future years, it is advisable to include long-term maintenance (minimum 10 years) in the tender for the heat mains installation contract. This will also ensure that the supplier offering the lowest life-cycle cost is selected, which will assist in maintaining low heat costs into the future. Consistent water treatment will also be required, to reduce maintenance and increase reliability.

Where the communal plant includes CHP, the CHP unit should be maintained under a long-term maintenance agreement. The maintenance agreement should include a long-term guarantee of the plant's availability, with appropriately valued penalties for failure to perform. Ten-year maintenance agreements with a guaranteed availability of 90% are standard in the small-scale CHP market (ie engines capable of generating up to 1 MW of electricity (1 MW_e)). Contracts for the maintenance of the heating internals can be let to general maintenance contractors because the equipment is standard. Heat meter and prepayment system administration, maintenance and calibration checks should be undertaken by the meter supplier.

Consideration should also be given to entering into an energy services contract (see section 6.2.3).

Contract administration costs will be minimised by appointing a single managing contractor responsible for various specialist sub-contractors (ie for CHP, heat mains and heat meters).

4 COMBINED HEAT AND POWER

4.1 WHAT IS COMBINED HEAT AND POWER?

Currently, most electricity is generated in large central power stations and distributed over the national grid. Typically, for fossil fuels, only around a third of the energy in fuel burnt at the power station reaches the consumer as useful electrical energy; the rest is lost as waste heat.

This waste heat cannot be harnessed for use by consumers because it cannot viably be distributed over long distances.

Combined heat and power (CHP) is a means of generating electricity locally to where it is needed and using the waste heat produced to contribute to the heat required in buildings. Almost any fuel can be used for CHP, including natural gas, municipal waste, and even biomass. Fuel is burnt in an engine or boiler to drive a generator to produce electricity. The engine also produces heat, in the same way as a car engine, and it is this heat which is recovered and used to provide heating. The high energy efficiency of CHP plants means that the cost of the heat and electricity they produce can be low.

Most CH schemes operate at relatively low temperatures and, for these schemes, gas engine CHP is usually the most cost-effective option. To maximise the heat that can be recovered from this type of engine and, therefore, achieve the best fuel efficiency, return water temperatures should be below 50°C. In this way efficiencies of 85% can be achieved.

For financial and technical reasons, CHP plant is generally sized to supply enough heat to meet summer hot water load. The remaining heating load is met using top-up boilers which can also be used when the CHP plant is undergoing maintenance. Electricity may also be topped up from the national grid when needed, and sold back to the grid when there is a surplus. These arrangements provide the maximum financial benefit and reliability of heat and electricity supplies.

COMBINED HEAT AND POWER

4.2 THE BENEFITS OF USING CH WITH CHP

Using CHP as a heat source for CH and selling the electricity can make a considerable difference to the economics of CH. This happens for two reasons:

- electricity is worth much more than heat and, therefore, contributes the bulk of the revenue from energy sales
- the electricity generation part of a CHP/CH system is less expensive than the heat distribution system despite producing electricity, a more valuable form of energy.

CHP plant can only operate if there is a heat load to supply, and CH schemes are ideal loads. Scheme owners should be aware of the potential for developing CHP to supply low-cost heat to existing or refurbished CH schemes. Furthermore, if CHP costs (capital charges, operations and maintenance and fuel) are largely covered by electricity sales, the price of heat can be kept down and will be more affordable to tenants. Therefore, it is important to maximise the value of electricity sales. The options for the sale of CHP electricity are discussed in more detail in section 5.3.

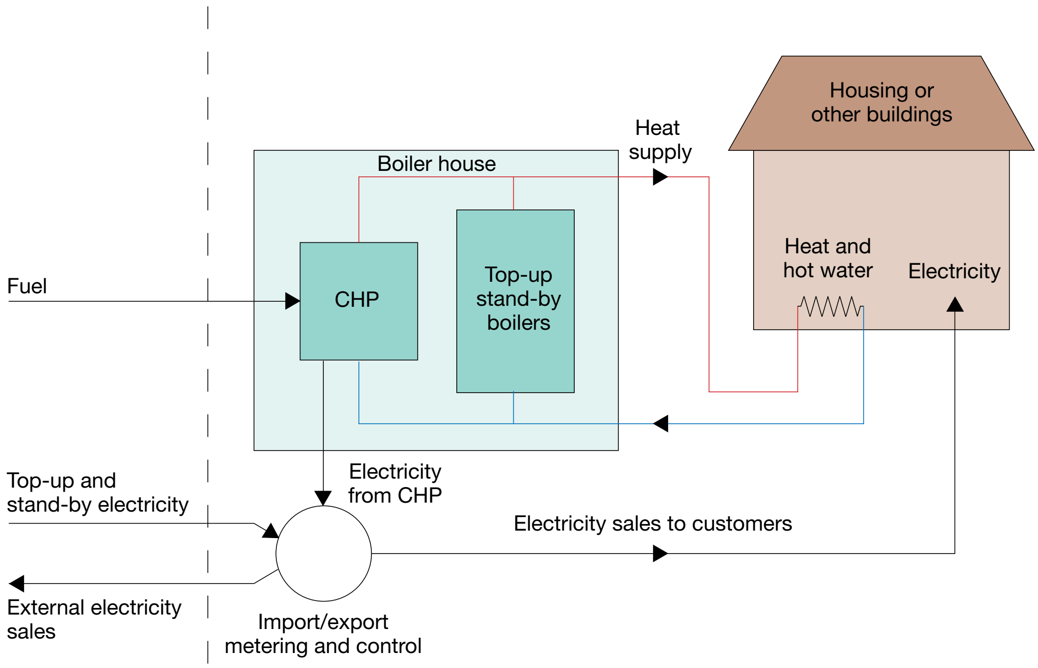


Figure 10 In practice, heat and electricity from CHP systems are supplemented by top-up boilers and by connection to the electricity distribution network. This ensures reliability of supply and provides opportunities for electricity sales to other customers

5 ECONOMICS OF COMMUNITY HEATING

5.1 CAPITAL COSTS

The capital costs associated with CH tend to be higher than installation of individual systems. However, there is a long-term financial benefit due to reduced life-cycle costs and lower heat costs than for individual systems (see below). CHP/CH also lend themselves to private financing (see section 6.2) thus reducing the capital requirements from the landlord. To provide indicative costs for budgetary purposes two scenarios have been considered (see table 2).

- ***Scenario 1 – improving an existing CH scheme including CHP***
  The costs per dwelling are for an estate of 600 dwellings (terraced housing and low-rise blocks of flats) where the heat mains require limited replacement. The costs include improving the controls to the dwelling heating system and complete replacement of the central plant, including the addition of a 600 kW_e CHP unit. It is assumed that minimal building work is required, ie the boilerhouse is retained.
- ***Scenario 2 – retrofitting CHP/CH to a tower block***
  CH is to be installed to replace electric storage heating in a 17-storey tower block with six flats per floor. The works include providing a communal boiler plant at the base of the block, distribution pipework and a new heating system in every flat comprising: radiators, controls (thermostatic radiator valves (TRVs) and a programmer) and a new hot water cylinder.

5.2 COST OF HEAT

The capital cost for CH per dwelling may be higher than for the alternative individual systems, particularly where it is retrofitted to relatively few dwellings where economies of scale do not apply. However, the advantage of CH is its low cost of heat production as compared to individual alternatives. Table 3 shows the cost of heat from alternative heating system options; the figures quoted include servicing and operation costs where applicable.

The figures in table 3 have been calculated with the following assumptions:

- *Electric heating*. Economy 7 tariff for 80% of the annual heat requirement with 20% top-up of peak-rate electricity. Maintenance costs are taken to be negligible.
- *Individual gas*. Domestic gas price 1.43 p/kWh, conventional gas boiler, pumping costs £8/year. Annual service and gas safety check £25 (assumes large contract).
- *Community heating*. Bulk gas purchase price is taken as 0.64 p/kWh for the larger 600-dwelling scheme and 0.8 p/kWh for the smaller scheme. A dwelling maintenance charge of £15 per year is included.

Heating system	Cost/dwelling without heat metering	Cost/dwelling with prepayment heat metering
600-dwelling CH improvement with CHP	£2850	£3350
100-dwelling CH retrofit with CHP	£6500	£7000

Table 2 Typical capital costs

Type of heating	Cost of heat to the tenants (p/kWh)
Electric off-peak	3.7
Individual gas central heating	2.3
Community heating	
■ existing 600-dwelling scheme with CHP	0.3
■ retrofit 90-dwelling scheme without CHP	2.6
■ retrofit 90-dwelling scheme with CHP	1.7

Table 3 Cost of heat from alternative heating system options

ECONOMICS OF COMMUNITY HEATING

5.3 SELLING ELECTRICITY

It is important to maximise income from electricity sales, as this in turn will affect the viability of CHP and the price of heat. The fact that the CHP plant only runs during periods of heat demand will dictate when electricity is generated and consequently who will buy it and the price it can attract. Broadly there are three options, a combination of which may be needed to maximise revenue.

- *Bulk electricity sales to public electricity suppliers (PESs)*. The simplest form of selling electricity is directly to the local PES. However, this option does not usually attract the best price.
- *Displacing landlords' supplies from a PES*. Using electricity in the landlord's own buildings (eg residential accommodation, town halls, leisure centres and care homes) can be more profitable, especially if the supplies are currently purchased during peak periods. This is easier if these buildings are near to the CHP unit, otherwise distribution use-of-system (DUOS) charges may have to be paid.
- *Retailing electricity to third parties, including tenants*. This option may generate more revenue than selling directly to a PES and may also be favoured by landlords wishing to provide affordable electricity to tenants. However, there will be extra costs involved in administration, meter installation and, possibly, payment of DUOS charges. The direct rate of electricity to tenants is discussed more fully in New Practice Profile 112.

5.4 BUYING AND SELLING HEAT

Heat sales to householders are dealt with in section 3.5. Operators of CH schemes may also be involved with bulk heat supply contracts. When buying or selling heat in bulk to or from third parties it is usual to adopt medium- and long-term contracts of 3 to 10 years. A one-off connection charge may also be necessary.

5.5 COST-BENEFIT ANALYSIS

Payback periods vary enormously due to the differences in installation costs from site to site, and variations in revenues from sales of heat and electricity. It is more appropriate to carry out the cost-benefit analysis using discounted cashflow techniques. This will reflect more accurately the lower life-cycle costs and benefits over the long term, plus any potential for selling heat and power to local industrial and commercial users.

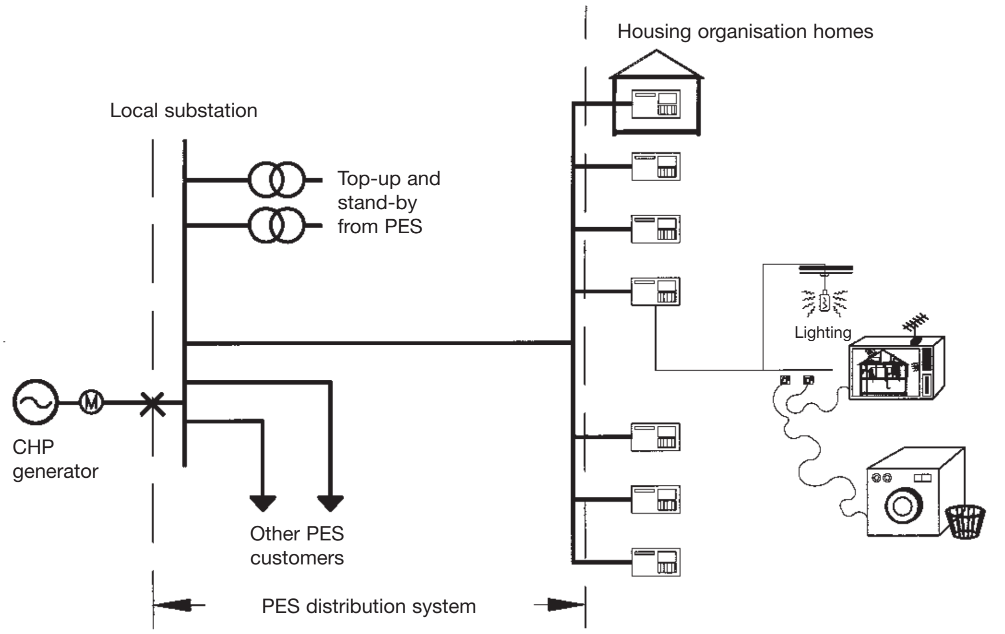


Figure 11 Arrangements for direct electricity sales, showing CHP generator, top-up and stand-by supplies, distribution system and customer meters

6 FINANCING COMMUNITY HEATING SCHEMES

6.1 SELF-FINANCING

For local authorities, CH and CHP can be financed from credit approvals under the housing investment programme. However, because CHP/CH schemes can be provided as part of a long-term service agreement, they are particularly well suited to private financing, thus releasing credit approvals to meet other needs.

6.2 PRIVATE FINANCE

6.2.1 Third party finance (not PFI)

A large part of the CH installation is external to the dwellings it serves. This makes it feasible to use private finance for CHP/CH schemes without having an impact on capital spending programmes. In these situations, a landlord can simply purchase heat and power at an agreed rate from the private sector which, in turn, takes responsibility for installation and operation of the central boiler house, generating plant, and main heat distribution network, including fuel purchase. The landlord may have to sell or lease the central boiler plant to the private sector operator to make this possible. In some cases electricity sales are used to subsidise the heat costs to the tenants.

6.2.2 The Private Finance Initiative

The Private Finance Initiative (PFI) encourages private-sector provision of a complete service and the transfer to the private sector of appropriate risks. Under the PFI, the public sector specifies its requirements in terms of outputs and the private sector designs, builds, finances and operates (DBFO) the asset to deliver the service required. Achieving value for money in PFI schemes depends on allocating risks to those best able to manage them.

An example may be the replacement of obsolete electric heating in a tower block with CH.

To provide the service to the required standard, the contractor is expected to invest in replacement CH with CHP and may also be required to improve the building fabric. An output specification based on the provision of a thermal service (ie room temperature) under agreed minimum external temperature conditions would represent the greatest transfer of risk to the contractor. More simply, and less onerous for the contractor, the level of service can be defined in terms of a minimum annual heat provision (kWh/year) for each dwelling type or for each block.

The charging structure in the agreement should include a 'service availability charge' to cover fixed costs including heat losses and pumping energy use, and an 'energy charge' for the units of heat actually used.

6.2.3 Energy services companies

Energy services companies (ESCOs) contract to provide an energy service, which may be defined in terms of agreed conditions for occupants. It becomes the ESCO's responsibility to invest in production, distribution and end-user equipment to ensure delivery of the service. Though ESCOs will be particularly interested in bidding for PFI projects they will not be restricted to this form of procurement.

ESCOs are currently being developed as public/private partnerships between local authorities and private-sector energy services providers.

6.3 GRANTS

From time to time grants are available for CHP/CH schemes. These are usually made available via the Combined Heat and Power Association (CHPA) or the Energy Saving Trust (EST) (see 'Further Advice' on page 18).

Further details on financing can be found in GIR 51 and GPG 234.

7 TENANT CONSULTATION

7.1 TENANT CONSULTATION

Retrofitting CH may involve replacing an old, familiar heating system with a new system and new controls and using a different 'fuel'. Furthermore, tenants may remain in occupation during the works, so cooperation will be required to prevent delays to the contract. Good communication with tenants before and during the contract will reduce the risk of the contract overrunning, and reduce housing management time spent in dealing with tenant queries. It is good housing management practice to consult with tenants when proposing changes to their heating systems. The consultation may involve the following.

- *Choice of controls.* Ask tenants about their preference for controls (programmer and TRVs) and radiator type during the design development phase, and incorporate this in the contract.
- *Show flat.* Equip a show flat in advance of the main installation contract. During open days and evenings suitably briefed staff should explain the heating system and its controls to tenants.
- *Tenant's handbook.* A clear and concise tenant's handbook should be provided to each resident on completion of the works by the contractor. Feedback from the consultation exercise can be used to make this document more 'user friendly'. Production of the handbook may be included in the contract and, if so, it is important that it is drafted well in advance of completion of the first property.
- *Information leaflets.* Tenants will want to know when their home is going to be upgraded and how long the installation will take. Keep tenants informed of progress by regularly issuing information.
- *Explanation of the charging system.* Tenants will need to understand issues related to meters and prepayment.

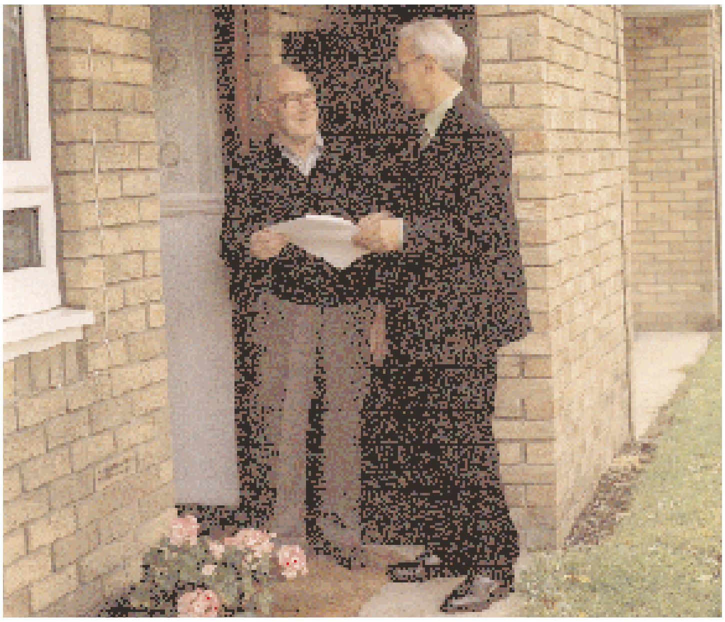


Figure 12 Jack Turnbull, North British Housing Association's (NBHA's) Technical Officer, in discussion with a tenant

It is imperative that tenants and other customers feel confident of a scheme once it is operational. It is particularly useful to enshrine commitment to the customer in a customer charter. This should cover areas such as:

- commitment to customers, eg advance warning of planned maintenance; back-up heat sources for domestic customers
- response to faults
- connecting to the CH network
- moving home
- meter reading
- method of payment
- strategies for non-payment, eg installation of a card system calibrated to ensure recovery of debt
- disconnection (but only as a last resort)
- complaints procedure.

8 ADVICE AND ASSISTANCE

8.1 CHECKLIST FOR APPOINTING CONSULTANTS

CHP/CH projects are specialist areas of building services and electrical engineering. When selecting a consultant to assist you with the development of CHP/CH projects, the following guidance should be followed.

Feature	Checked
Assess previous experience from project profiles	
Assess capability of key staff by reviewing CVs and seek assurance that these staff will be used on the project	
Request list of relevant completed housing projects with client contacts	
Take up references	
Ask for experience of participating in tenant consultation	
Ask for experience of project managing tenant-in-place heating refurbishment contracts	
Find out if the consultant has software for hydraulic analysis and CHP plant optimisation	
Ask if the consultant is a member of an organisation authorised to deliver Standard Assessment Procedure (SAP)* ratings and/or is familiar with CH and CHP in SAP	

8.2 FEASIBILITY STUDIES CHECKLIST

The study should include the following.

Feature	Checked
Assessment of the available heat load using a recognised analysis tool, eg SAP or the Chartered Institution of Building Services Engineers (CIBSE) procedure; to include impact of fabric improvement measures	
Evaluation of technical solutions for CH: sources of heat, system operating conditions (temperatures, pressure constraints), controls options (programmer and TRV selection)	
CHP assessment including maximisation of electricity sales revenues (direct sales to residents)	
Opportunities for energy linking	
Options for heat charging – tenant preference/landlord policy	
Economic evaluation of life-cycle costs, compared with alternative heating solution, eg individual gas or all electric plus improved insulation	
Estimation of running costs to tenants (£/week) and comparison with landlord's affordability criterion	
Evaluation of environmental impact including the contribution to Local Agenda 21 and Home Energy Conservation Act (HECA) strategies	
Financing options including private finance and grants	

8.3 TECHNICAL BEST PRACTICE CHECKLIST

Feature	Checked
Individual room temperature control	
Independent control of heating and hot water with motorised control valves	
Direct connection to the dwelling	
CIU with sealed metal cover in each property	
Differential pressure control valve and regulating valve fitted to each property	
Flow and return temperature difference greater than 25°C	

Feature	Checked
Flow temperature below 90°C	
Return temperature preferably 50°C	
Variable speed pumping	
Pre-insulated heat distribution mains	
Moisture detection alarm system in heat mains	
Energy management system controlling central plant	
Heat from gas engine CHP or EfW plant	

*The SAP was extended to include CH and CHP in 1997. Further information can be found in the publications listed on page 19.

FURTHER INFORMATION

FURTHER ADVICE

The following organisations are useful contacts for providing further advice on community heating.

Combined Heat And Power Association

Grosvenor Gardens House, 35-37 Grosvenor Gardens, London SW1W 0BS
Tel 0171 828 4077. Fax 0171 828 0310

Energy Services Association

Address and telephone number as for CHPA, above.

Public/Private Partnerships Programme (4Ps)

35 Great Smith Street, Westminster, London SW1P 3BJ
Tel 0171 664 3145. Fax 0171 664 3030

BRECSU and ETSU

See details on the back cover.

THE PRIVATE FINANCE INITIATIVE

General enquiries to:
Robert Gregory, DETR Private Finance Unit
8/11, Ashdown House, 123 Victoria Street
London SW1E 6DE. Tel 0171 890 5015

Enquiries on the Local Government (Contracts) and Capital Finance Act to:
Mark Frankel, Local Government Capital Finance Division, Floor 5/F2, Eland House Bressenden Place, London SW1 5DU. Tel 0171 890 4229

EUROPEAN STANDARDS

Pre-insulated community heating mains and fittings are covered by the following standards: EN253, EN448, EN488 and EN489.

Heat meters are covered by EN1434.

DESIGN ADVICE

For a free environmental consultancy on building projects call Design Advice on 01923 664258.

DETR ENERGY EFFICIENCY BEST PRACTICE PROGRAMME PUBLICATIONS

The following Best Practice programme publications are available from BRECSU Enquiries Bureau. Contact details are given on the back cover.

Good Practice Guides

1 Guidance notes for the implementation of small scale packaged combined heat and power
3 Introduction to small scale combined heat and power
82 Energy efficiency in housing – guidance for local authorities
234 Guide to community heating and CHP. Commercial, public and domestic applications

General Information Reports

50 Unlocking the potential – financing energy efficiency in private housing
51 Taking stock – private financing of energy efficiency in social housing

Good Practice Case Studies

80 Rejuvenation of community heating – pipework refurbishment in Manchester
81 Community heating in Sheffield
82 Consumer connection to community heating in Sheffield
312 Community heating in Nottingham: an overview of a rejuvenated system
313 Community heating in Nottingham: domestic refurbishment
314 Community heating in Nottingham: pipework refurbishment
370 The use of combined heat and power in community heating schemes

New Practice Profile

112 Opportunities for electricity sales to tenants from residential CHP schemes

FURTHER INFORMATION

New Practice Report

113 Selling CHP electricity to tenants – opportunities for social housing landlords (to be published by BRECSU)

The following Best Practice programme publications are available from ETSU Enquiries Bureau. Contact details are given on the back cover.

Good Practice Guide

115 An environmental guide to small-scale combined heat and power

THE FOLLOWING DETR PUBLICATIONS ARE ALSO AVAILABLE FROM BRECSU

'Energy Services for the Public Sector – A Working Guide'. Department of the Environment, Transport and the Regions (1996)

The Government's Standard Assessment Procedure for Energy Rating of Dwellings. 1998 edition

Standard Assessment Procedure – authorised organisations

Energy Efficiency Best Practice in Housing

Tel: 0845 120 7799
www.est.org.uk/bestpractice

Energy Efficiency Best Practice in Housing is managed by the Energy Saving Trust on behalf of the Government. The technical information was produced by BRE.