Energy Efficiency Best Practice in Housing

Community Heating – a guide

- Environmental benefits: lower emissions
- Social benefits: taking homes out of fuel poverty
- Economic benefits: lower whole life costs

ENERGY EFFICIENCY
SAVE ENERGY MONEY ENVIRONMENT

Contents

1 Executive summary

This guide is written for housing or planning officers within local government, and managers within other housing providers, including Housing Associations, ALMOs (Arms Length Management Organisations) and TMOs (Tenant Management Organisations).

Community Heating delivers heat to more than one building, dwelling or customer from a central source. It may also provide power or cooling[1]. The heat supply may come from waste heat produced in power generation (Combined Heat and Power or CHP) or from industry, and it may employ renewable energy sources such as biomass or wastes.

Community Heating is likely to be most appropriate in relatively dense housing (low rise and high rise blocks). Off-gas communities, such as lower density towns or villages, may also be suitable with oil, solid fuel heating, or electricity being displaced. Additional loads, such as schools, council buildings, leisure centres, and even hospitals or university campuses can be served from these schemes.

Community Heating has significant economic, environmental and social benefits. It can make a significant contribution to local authority objectives such as Local Agenda 21 and HECA commitments, contribute to area regeneration and the creation of sustainable communities.

Community Heating should be assessed through a site-specific option appraisal. This should ideally be based on the Treasury's Green Book Guidance for evaluation of public sector investment[1]. Currently, this involves whole-life evaluation accounting for all costs and benefits, including income and expenditure (such as energy maintenance and replacement costs) over a 25 year period, and discounted back to current values using a discount rate of 3.5%.

Some housing managers and tenants regard Community Heating as expensive and unreliable. However, this view is based on experience of 20-40 year old systems that have not been adequately maintained or updated. Modern systems, in appropriate developments (especially dense urban developments) can be the best practical environmental option, with significantly lower carbon emissions than alternatives. And whilst up-front costs may be higher, Community Heating can be the least whole-life cost option. However, residents need to be involved, with representation on the management board, and they need to be consulted on the choice of controls and location of energy generation centres.

Opportunities for housing managers include:

- the possibility of retaining and upgrading of existing networks
- the conversion of electrically heated dwellings to community heating
- the provision of low cost electricity to dwellings which remain electrically heated
- collaboration with planners and councillors on a strategy for community heating in:
  – new build or refurbishment
  – at the point of transfer of housing stock to ALMOs
  – small scale or large scale transfer of dwellings
- involvement of other public sector organisations such as hospitals or universities in the development of an overall strategy for an area.

2 Aim of the guide

This guide explains how housing management issues, technical questions and economic considerations impact on the use of Community Heating, and why they need to be taken into account at the design and development stages of refurbishment and regeneration projects. The guide also contains information about legal, insurance and environmental issues.

There are several other guides available on Community Heating. More detailed guidance on technical and financial issues, for example, can be found in Good Practice Guide 234 Guide to Community Heating and CHP[2]. Other sources of further information and advice are listed in Section 10.

3 About Community Heating

3.1 What is Community Heating?

A Community Heating scheme provides heat from a central source to more than one building or dwelling via a network of heat mains. Heat can be supplied from conventional boilers or boilers using renewable energy sources: the waste heat from power generation (known as Combined Heat and Power or CHP) can also be used. A Community Heating scheme may provide cooling via an absorption chilling plant.

Community Heating is likely to be most appropriate in relatively dense housing (low rise or high rise blocks) and is most cost-effective where an existing heat network can be refurbished and retained, or where electric heating is displaced. Off-gas communities, such as lower density towns or villages, may also be suitable with oil, solid fuel heating, or electricity being displaced. Additional loads, such as schools, council buildings, leisure centres, and even hospitals or university campuses can be served from the same schemes.

Community Heating schemes vary in size. They may consist of individual tower blocks, a university or hospital campus, an area undergoing regeneration, or whole portions of a city as in Southampton, Sheffield, or Nottingham.

> Some schemes, both refurbishment and new build, are small (less than 100 dwellings). Many local authorities or housing associations with small sites have portfolios of projects. The Community Energy programme has a guide to small scale community heating, downloadable from www.est.org.uk/communityenergy

Schemes can start with the installation of a heat network linking buildings together, initially utilising fossil fuels. Once a viable heat network is established, a fuel-flexible energy centre can introduce renewables such as biogas, woodchip or other choices.

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[1] See www.hm-treasury.gov.uk/Economic_Data_and_Tools/greenbook/data_greenbook_index.cfm

[2] Go to www.thecarbontrust.co.uk and search for GPG234

In densely populated or tall developments, the costs of making a building explosion-proof and a gas network vandal-proof are significant. In these circumstances, electric heating is often the developers' choice. However, under current building regulations, electric heating requires significant changes to the fabric of a building, including, for example, reduced glazing. Large scale investment in electrical infrastructure, possibly including new substations, is also necessary. In these circumstances, Community Heating employing CHP or renewables may be financially attractive and offer significant environmental benefits.

3.2 Elements of a scheme

The physical elements of a Community Heating system are a central heat source, a heat distribution network and end-user installations in each dwelling. Maintenance procedures are also essential to ensure reliable operation.

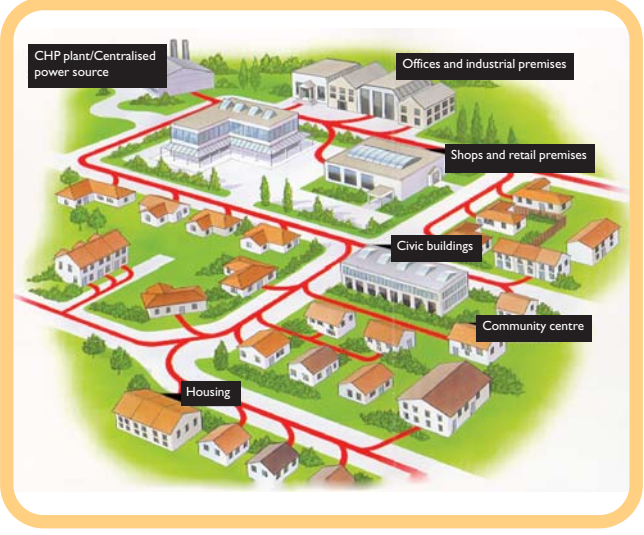

Figure 1: Community Heating distribution network

Heat sources

Community Heating can use a wide variety of fuel choices beyond those available to individual domestic systems. These include:

- waste heat from power generation. In conventional electricity generation, most of the primary energy input is lost as waste heat (see Figure 2). CHP systems, on the other hand, recover the heat and this can be used for Community Heating. CHP systems therefore are very efficient, with much lower environmental impact and heat production costs
- energy from waste (EfW)
- waste heat from industrial processes
- geothermal and even solar energy

Even with conventional boilers, there is the potential to achieve better efficiencies and greater security of supply through the use of multiple boilers. Heat sources can be switched (and at short notice if the system is set up for this) according to availability and/or price.

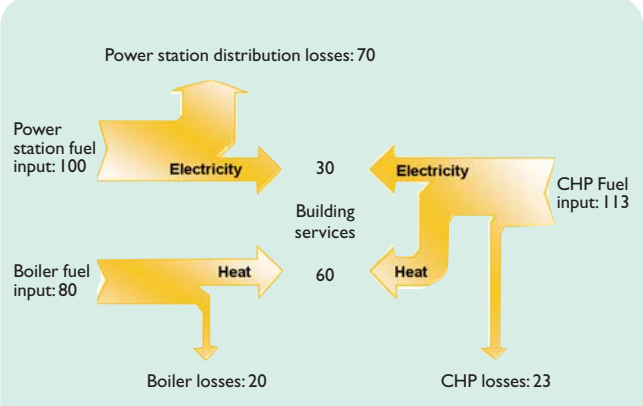

Figure 2: Nominal heat and power production from conventional sources and from CHP

There may also be scope for 'energy linking', which is the joining up of Community Heating schemes on adjacent sites to provide mutual backup for heat sources and better utilisation of the heating plant. This can be particularly effective where customers of different systems have different consumption patterns. In the same way, it can be advantageous if Community Heating systems supply both domestic and non-domestic customers.

Heat distribution

The distribution network transfers heat from its source to the individual dwellings on the system. For a single-building system, the heat distribution network may simply consist of a pump with valves and pipes (with insulation) similar to those used in a conventional central heating system. For schemes serving a number of buildings, larger 'heat mains' are used, usually with variable speed pumps that reduce the energy costs of pumping. These heat mains consist of pipes that are pre-insulated to a very high standard and buried in the ground in the same way as other mains services. They incorporate integral leak detection systems, and they are manufactured to European standards designed to ensure their reliability over at least 30 years. Some systems have a separate distribution network for centrally-generated domestic hot water.

Figure 3: Pre-insulated heat mains

End-user installations

Residents will see little difference in the heating equipment in their homes. Community Heating systems generally use conventional radiators and there is no difference in the kind of controls, with the same type of time switches/programmers, thermostats and TRVs. The only significant difference is the 'Hydraulic Interface Unit' which replaces a gas bolier. This contains the incoming and outgoing heat mains, control valves and metering. Pipes run from this to the radiators and (if present) the hot water cylinder. Some units include a plate heat exchanger to provide instantaneous domestic hot water – similar to a combination boiler (and eliminating the hot water cylinder). As with individual systems, it is important that tenants understand how to use their heating controls, whether the supply of heat is to be metered or not; wherever possible they should be involved in the choice of controls.

Figure 4: A typical Hydraulic Interface Unit (the connections are similar to those of a conventional gas boiler except that, instead of being connected to a gas main, it is connected to a heat main).

4 Why is Community Heating receiving increased attention?

Today, there is increased interest in Community Heating for several reasons:

- technical change which delivers environmental benefits and improved reliability
- support from the Community Energy programme
- the transfer of housing to the private sector with consequent opportunities to bring in private sector investment
- clarification of legal powers

4.1 Technical change

Community Heating today is a mature technology and has developed a long way from the sometimes unreliable and inadequate early systems. In today's schemes:

- significant environmental benefits can be achieved through the use of small scale CHP and/or renewables
- the end-user can control heating levels just as well as with individual boiler heating systems
- electronic heat meters are available with pre-payment and remote reading facilities
- heat distribution problems have been overcome through better design
- buried heat mains are factory-insulated and fitted with fault detection sensors
- contractors are committed to high quality installation practices
- maintenance contracts and warranties of up to 15 years are available from equipment suppliers
- private finance is available from specialist Energy Service Companies.

Within the EU, 22 million people (some 6% of the population) benefit from Community Heating schemes in their homes, offices or factories (see Table 1). In some urban areas of Scandinavia, the figure rises to 90%.

Table 1: Community Heating as a proportion of the domestic heating market

Country	Proportion (%)
Denmark	54
Finland	50
Netherlands	3
Germany	12
UK	1

Source: Euroheat & Power, 2003

4.2 The Community Energy programme

In 2001, the Government launched a £50 million grants programme called Community Energy, designed to encourage the refurbishment of existing public sector schemes and the development of new ones. In three years the programme has triggered around £200 million of total investment.
For further information, including case studies, as well as financial guidance, visit www.est.org.uk/communityenergy

A Community Energy capital grant of almost £660,000 enabled Aberdeen City Council to address issues of hard-to-treat properties and fuel poverty – see Figure 5 overleaf. The grant, equivalent to 40% of total capital costs, was used to upgrade their multi-storey and low-rise housing. The scheme achieves a reduction in fuel bills and CO_2 emissions of 40%. See Community Heating - Aberdeen City Council Case Study (CE65), downloadable from www.est.org.uk/bestpractice

Figure 5: High rise properties in Aberdeen

4.3 The Housing Transfer programme

With the separation of strategic management from housing provision, responsibility for managing much of the local authority housing stock has been transferred, either through Large Scale Voluntary Transfer (LSVT) or small-scale transfer, or the setting up of Arms Length Management Organisations (ALMOs). Transfer allows the use of private funding to refurbish dwellings, including the replacement or installation of Community Heating. Indeed, sales of heat and electricity from these schemes can finance significant borrowing; the revenue flows can also be used to justify leasing agreements in refurbishment projects.

More on opportunities to refurbish or install networks at the point of transfer can be found in Financing Community Energy Schemes at: www.est.org.uk/communityenergy/information/pdf/Annex_D.pdf

4.4 Changes to local authority powers

Local authority powers have been clarified to make clear that they do have the powers to set up and manage partnerships or energy service companies (ESCOs).

Section 2 of the Local Government Act 2000 gives local authorities the power to do anything that they consider is likely to "achieve the promotion or improvement of the economic, social or environmental well-being of their area". Guidance from the Local Government Association (LGA) gives the generation and supply of energy as one possible application[3], provided:

- the project is in keeping with the authority's community strategy
- the authority complies with its usual obligations of Best Value when implementing the project
- the authority does not make a net revenue surplus or profit from the operation. Section 95 of the Local Government Act 2003 will however allow the authority to charge in carrying out this activity.

The 2000 Act also gives local authorities the power to provide energy efficiency and conservation measures. Section 93 of the 2003 Act allows local authorities to charge for services provided that:

- the authority is authorised to provide the service
- the person receiving the service has agreed to its provision

5 Benefits of Community Heating

5.1 Environmental benefits

Where CHP is the heat source, savings in primary energy (and therefore emissions) of 25% or more can be made compared to alternative methods of providing heat and electricity. Where renewables are used to provide heat, there may be little in the way of primary energy savings (unless electricity is displaced) but CO_2 emissions can be reduced or even virtually eliminated.

Figure 6 shows the carbon emissions associated with heat from different types of heating system. Carbon emissions for electric heating are high because centralised power stations are relatively energy inefficient and a proportion of the energy is lost transferring it from the power station to the end user. Gas-fired boilers release much less carbon and condensing boilers are less polluting than conventional versions. It is likely that when micro CHP becomes available, it will offer savings compared to conventional boilers, but will not achieve as low carbon emissions as a heat network with CHP in dense developments. Where heat is provided by CHP with Community Heating, emissions related to heat production may be close to zero, or even negative. This is because in SAP calculations[4], the electricity generated by CHP is taken as having a carbon emissions factor equivalent to that for electricity generated by new gas fired power stations, and any remaining carbon is assigned to the heat produced. In this case, the carbon emissions allocated to heat is close to zero (and if negative, treated as zero).

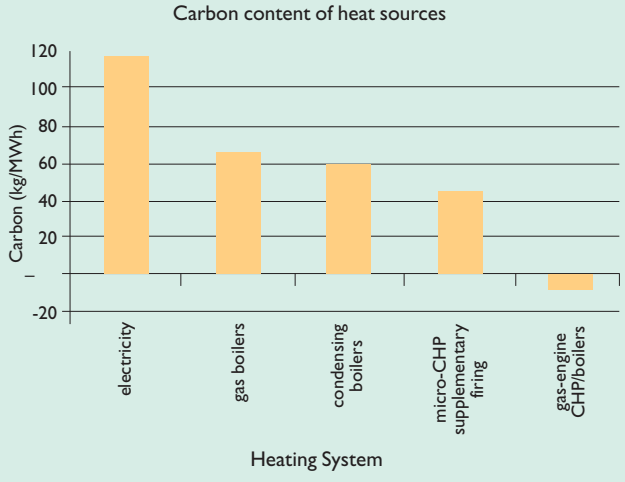

Figure 6: A comparison of emissions per useful kWh for different heating systems

[3] See www.lga.gov.uk/Publication.asp?lSection=0&id=-A781D7A3

[4] The Government's Standard Assessment Procedure for Energy Rating of Dwellings, 2001 edition, currently being updated and due for release in 2005.

5.2 Social benefits

- **Affordable warmth.** Savings from bulk fuel purchasing and higher efficiency plant (such as CHP) can be passed on through lower charges. Affordable warmth reduces fuel poverty, improves comfort standards and reduces the incidence of cold-related and respiratory illnesses such as hypothermia and asthma
- **Low cost electricity.** If Community Heating is supplied from CHP units, the electricity generated can be sold directly to residents. This provides affordable warmth and cheaper electricity.
- **Control.** Individual room control, as well as programmable heating and hot water, are standard features on modern Community Heating. Systems can be designed to maintain a pre-set heating level to prevent building fabric deterioration, with the option for residents to pay for higher room temperatures
- **Abundant hot water.** Domestic hot water cylinders with fast recovery times can be incorporated into Community Heating systems. Alternatively, compact heat exchangers can be installed in place of the cylinder which releases the storage space normally assigned to the cylinder – and the heat exchanger will outperform standard gas-fired 'combi' boilers
- **Pay for what you use.** Modern metering can ensure that residents only pay for the heat they use. Prepayment meters using smart cards are an option. Remote meter reading is also possible

5.3 Economic benefits

Lower lifecycle costs. Over its lifetime, the cost of Community heating can be significantly lower than the alternatives. Benefits include:

- **lower maintenance costs.** If tenants keep their homes warm, the risk of damp and condensation is greatly reduced, resulting in less remedial work. In addition, the annual costs of servicing individual domestic boilers are eliminated
- **lower management costs.** Warm homes mean satisfied tenants. Affordably heated homes have:
  – lower rent arrears
  – lower void rates
  – fewer changes in tenancy
- **higher rents.** Homes with full heating attract higher rents
- **less safety checks.** Annual gas boiler safety checks are eliminated as there is no boiler in the dwelling. However, many dwellings will still have gas cookers and fires. As all gas appliances need a regular safety check, it may be appropriate to remove all gas heating and cooking appliances in order to avoid annual gas safety inspections

6 Potential opportunities for Community Heating

The potential for Community Heating is enormous, particularly in:

- the refurbishment of existing buildings, especially in dense urban areas with high rise or low rise housing currently using electric heating or with an existing heat network. Public buildings such as hospitals Universities, and council or other offices may also be suitable
- new build, especially in dense, new, urban developments promoted under the Sustainable Communities Plan
- small communities off the gas network that could utilise renewable energy sources

6.1 In existing buildings

Community Heating with CHP is predominantly an urban technology: London accounts for over a quarter of the total potential and our 12 largest cities make up around 60% of the potential in existing buildings.

The prime candidates for Community Heating will be high rise buildings (defined as more than six stories). As Table 2 shows, some 942,000 dwellings are high rise, of which 245,000 have electric heating and 105,000 already have a heat network. These would be prime candidates for refurbishment. On top of these, 126,000 high rise properties have no central heating. At lower discount rates, schemes for low rise and maisonettes become cost effective.

Table 2: Heating systems in each dwelling type in the UK (thousands)

	Total	Flats: low rise and maisonettes	Flats: high rise
Number of homes	24,040	3,577	942
% of total	-	15%	4%
Without central heating	3,000	549	126
Homes with central heating	21,040	3,028	816
% of total with central heating	88	85	87
Type of heating system			
Central heating - solid fuels	731	41	-
Central heating - mains gas	16,730	2,098	455
Central heating - electric	2,333	727	245
Oil	771	6	7
Bottled gas	192	8	4
Existing community heating	283	148	105

Community Heating in the UK could serve between 194,000 and 5.5 million homes depending on the cost of money assumed (see table 3). In many urban areas, estates include (or are adjacent to) other buildings including schools, hospitals, student accommodation, government or local authority buildings. The ideal scheme would link those adjacent buildings with differing patterns of heat demand. For example, the same energy centre can serve flats predominantly in the morning and evening, but a school during the day. Energy linking in this way can improve the cost effectiveness of the technology.

A study examining electricity and heat demand for 8,000 UK postcodes – based on the density of heat demand – modelled whether Community Heating would be cost effective, based on the density of heat demand. A series of maps were drawn, such as this one of central London (see Figure 7). Areas coloured pink had high heat demand density. Areas coloured red had very high heat demand.

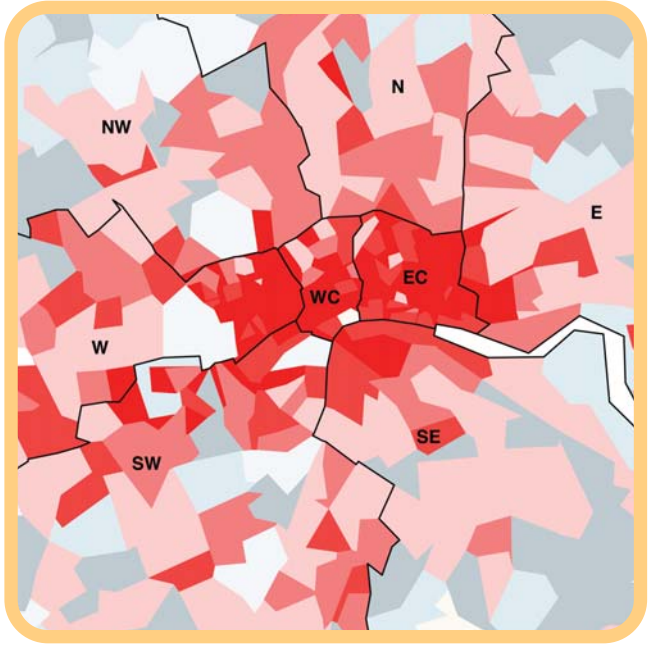

Figure 7: Different heat demands across central London

The maps can be downloaded from the Community Energy website (www.est.org.uk/communityenergy). Some of the data can be incorporated into Geographical Interface Systems to aid local planning.

To determine whether CHP-based Community Heating was cost effective, it was assumed that Community Heating would need to supply heat and power at 15% less than current heating methods, and generate a positive return for a private sector developer. The study used different rates for the cost of money (the discount rate) depending on whether it would come from the public or private sectors. Discount rate is critical to cost effectiveness (see Table 3). The Treasury has until recently used a discount rate of 6%, which was used for this work, but has recently revised its discount rate to 3.5%, so in theory, an even higher installed capacity is cost effective. However, since much of the money and expertise would be private sector, a higher discount rate is valid. If all the money comes from the private sector, a discount rate of 9-12% may be valid.

A study of The potential for CHP in Community Heating can be downloaded from www.est.org.uk/communityenergy

Table 3: Potential for CHP-based Community Heating systems, in terms of buildings connected and discount rate applied

Heat customers	Units	Discount rate		
		6% and above	9% and above	12% and above
Dwellings	Number	5,528,000	404,000	194,000
Universities	Number	82	44	41
District hospitals	Number	205	35	21
Secondary schools	Number	754	50	25
Government estate buildings	Area (10^6 m^2)	1.63	0.63	0.50
Local authority offices	Area (10^6 m^2)	2.83	0.86	0.73
Private sector offices, warehousing and retail	Area (10^6 m^2)	285.89	85.91	35.94

6.2 In new build

New build potential is additional to that discussed for existing buildings above. Most new build will be constructed by private developers, and assuming a project lifetime of 20 years with a discount rate of 12%, new developments of 55 or more dwellings per hectare are, prima facie, likely to be cost effective.

For smaller developments of 100 homes or less, (typical of infill projects) densities may need to be around 75 dwellings per hectare to be cost effective. These tend to have a higher capital cost per kW. However, if such projects can connect to a larger existing or planned scheme, such limitations do not apply.

New developments being promoted under the Sustainable Communities Plan are likely to have densities of 35-300 dwellings per hectare, and may therefore be cost effective.

The cost of individual boilers and gas connections (if gas is the chosen fuel) can also be offset against the cost of a Community Heating scheme in new build.

The planning system can help, for example through Supplementary Planning Guidance, Planning Frameworks, legacy agreements on land sale or transfer, and Section 106 agreements.

At the start of 2006, the EU Energy Performance in Buildings Directive will require that developers of all new buildings (or major refurbishments) with more than 1,000m^2 of floor area must show they have considered CHP, renewables and connection to a heat network. The best way of doing this is to conduct an option appraisal (see Section 5).

Most developers will not want any ongoing financial involvement after handover. The ideal solution in this circumstance is to involve an Energy Services Company (ESCO) which would take on all design, installation, financing, commissioning and operating liabilities. Developers would therefore be advised to develop an early partnership with an ESCO, to permit an integrated design approach to the installation.

In all new build projects, an electrical network is installed to connect the individual dwellings to the substation. Usually, this network is handed over to the local Distribution Network Operator (DNO) to manage and maintain. The costs of this are paid through a Distribution Use of System Charge (DUOS Charge). If this asset is installed by the ESCO, with ownership and maintenance liabilities retained by the ESCO, electricity from CHP or PV can be sold direct to tenants with no Use Of System (UOS) charges. Then a price closer to the market figure is achievable (6-7p per kWh rather than around 2p per kWh if UOS fees are also payable). This approach is likely to fundamentally alter the economics of CHP, making it more attractive in new build. Such an arrangement should be considered carefully.

A guide to Community Heating for Planners and Developers can be downloaded from www.est.org.uk/communityenergy
The guide includes a number of possible planning case studies.

6.3 Renewable energy

There is a further potential for renewable energy schemes, in both urban and rural areas. Urban schemes can use alternative fuels besides natural gas, including:

- geothermal
- biomass (such as tree waste which would otherwise go to landfill)
- biogas (produced for example, from anaerobic digestion of food waste)
- landfill gas. Many landfill sites vent methane to reduce explosion risks. Others burn the methane in reciprocating engines and generate electricity. However, most of these schemes dump the heat. There is a good opportunity to recover this heat at low cost to the benefit of the local community

Some 20% of UK households are not on a gas network. In some areas, if an identifiable community exists, the best alternative to electric heating, solid fuels or oil heating would be an energy centre using renewables and serving the community through a heat network. Even though such networks are unlikely to have the same density as in urban areas, the fact that renewables are displacing other forms of energy may make them attractive in cost and carbon terms.

Table 4: Size of communities not served by the gas network

	>150 dwellings	>300 dwellings	>750 dwellings
Scotland	281	131	13
Wales	396	139	8
UK total	4,017	1,341	105

NB: only communities that have requested a connection have been counted. The figures shown are cumulative, i.e. of the 4,017 UK communities, 1,341 have >300 dwellings, of which 105 have >750 dwellings.

Table 5: Distance of communities from a gas connection point

	Total	<2 km	2-7 km	>7 km
Scotland	281	35	101	145
Wales	396	84	237	75
UK total	4,017	1,279	2,218	520

NB: only communities that have requested a connection have been counted

A guide to new and renewable energy in Community Heating can be downloaded from www.est.org.uk/communityenergy
The guide covers key issues for a range of new and alternative fuels, such as biomass, biogas and landfill gas, energy from waste, ground source heat pumps, geothermal, and coal mine methane.
A number of case studies are included. The Rural biomass Community Heating case study (CE91) can be downloaded from www.est.prg.uk/bestpractive

7 Is Community Heating appropriate in this development?

The viability of any project needs to be examined through an appraisal of the different options, and the development of a business plan. This will need to be undertaken by an appropriately experienced consultant, who will need technical, economic and business expertise, as well as an understanding of the energy market. The consultant may need to involve subcontractors with specialist knowledge in some areas.

7.1 Option appraisal

A site-specific option appraisal explores the technical and financial viability of the different possibilities in order to determine the most appropriate choice. While the report outlines in detail why a type of space heating and hot water system option is preferred, it would not be expected to describe the precise implementation programme.

The appraisal must use a consistent set of economic criteria across all the options. The method preferred by Government is 'whole life costing', outlined in the Treasury's Green Book (see Section 9). This takes into account: capital and running costs; replacement costs and revenue streams; and the benefits to each stakeholder. The evaluation covers the life of the scheme (currently taken to be 25 years). Future costs and benefits are discounted to present values, (currently at 3.5% per annum). The scheme with the highest Net Present Value or NPV (if positive), or lowest whole life cost (if negative) is the preferred investment.

Stakeholders may prefer another method of evaluation, such as simple payback period, Internal Rate of Return (at more commercial rates) and so on. Any such investigation should, however, be in addition to Green Book analysis.

The key stages of whole life costing for Community Heating are:

1. Identify the heating options for each scheme (consider domestic and non-domestic buildings separately). These might include:
- community heating (gas heat only, gas CHP, or renewables-fired boilers)
- individual gas central heating boilers
- electric storage heating

2. Select an appropriate project lifetime – usually 25 years. Given the life expectancies of the space heating and domestic hot water options listed, some will need replacing within the evaluation period, and replacement costs (discounted to current prices) need to be included.
- community heating – life expectancy about 25 years
- individual gas boilers – life expectancy about 15 years
- electric storage heating – life expectancy about 10 years

3. Identify both the capital costs and the operational running costs for each option, along with any revenues and ongoing expenditure. Then create the resultant cash flow forecasts for each year.

4. Calculate the NPV and discount the cash flow to current values. Yearly future cash flows can then be calculated to obtain their value in today's terms.

5. Total the discounted cash flows to arrive at the cumulative NPV. This will probably be a negative figure. Identify the least negative NPV: this is the best option, the lowest whole life cost.

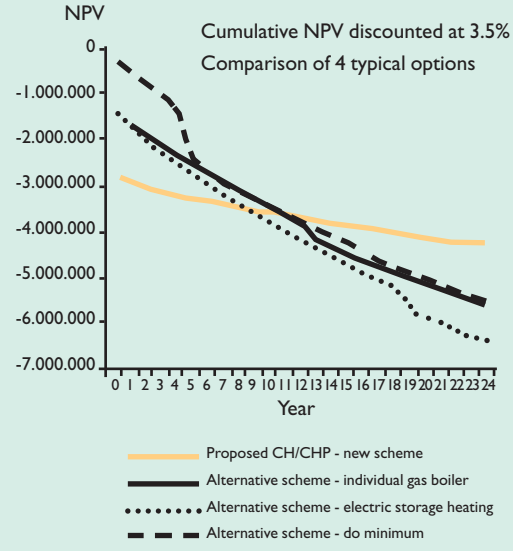

Figure 8: NPV assessment of Community Heating compared to other options for provision of energy services

7.2 The business plan: managing risk and securing finance

If Community Heating is the preferred investment, a business plan outlining the best way of delivering the scheme is needed.

There are several vehicles for the finance and management of a scheme. These include:

- **in-house management.** The local authority or RSL carries all the risk, but retains the benefits from installing community heating. Some organisations have set up wholly-owned companies to manage the scheme.
- **a partnership arrangement.** The local authority or RSL and a private sector partner deliver the scheme. Some ownership – and therefore strategic control and profit – are retained, but some of the risk is transferred to the private sector. A key element is that the project is 'off balance sheet', overcoming many of the financial restrictions imposed on the public sector. Partnerships are often 'non-profit distributing': any operating surplus produced is recycled into further community benefits or energy saving measures.
- **ESCOs.** All the risk and responsibility is transferred to the private sector. In these circumstances, some or all of the scheme will probably belong to the ESCO. The ESCO will be responsible for finance and maintenance. The contract will be for the provision of electricity and heat, not the scheme itself. Payments are likely to be annual payments, not up-front capital payments. However, the private sector will clearly want to make a profit for running such a scheme. Again, such an arrangement moves the financing of a scheme 'off-balance sheet'.

There are parallels between the partnership approach and the 'arms length management organisation' (ALMO) approach to managing housing, and also between ESCOs and Housing Transfer. These management concepts will therefore be familiar to housing managers.

A typical business plan should describe:

- structure of the vehicle, and the arrangements for tendering, appointing and managing. It should also include the relationship to any managing agent or residents association
- the finance options including private finance, loans, project finance, grant programmes and other sources (including leasing options as well as capital finance)
- plans to optimise revenue generation (e.g. growth of the scheme to sell heat to customers beyond the core development's heat load; sales of electricity from CHP to other buildings belonging to the same organisation, or direct to other customers)
- a robust analysis of money flows (revenue and expenditure)
- a detailed project plan with all proposed activities/tasks and deliverables (such as consents, planning and environmental approvals, consultations, tendering or partnering processes and the establishment of legal bodies)

Further guidance on financing vehicles – including examples of in-house management, partnerships and ESCO arrangements – can be found in Financing Community Heating, available on the which can be downloaded from www.est.org.uk/communityenergy

This includes sections on sources of finance for Community Heating including private sector loans and grants schemes such as Affordable Warmth, EEC and Community Energy.

Guidance on energy services in the public sector is also available. See for example:
Guidance on Procuring Energy Services to Deliver Community Heat and Power Schemes (GPG377), and Getting signed up – energy services in the public sector (GPG289), both available from www.thecarbontrust.co.uk

There is also specific guidance on sources of finance for renewables-based schemes.

7.3 Getting best value for electricity generated

CHP increases the environmental benefits of Community Heating. However, in order to maximise the economic benefits, it is important to consider how to get best value for electricity generated.

Many schemes simply sell the electricity to an electricity supplier. Under recent changes in the electricity market, it is worth around 1.5-2p/kWh. Yet if the electricity is used in premises owned by a large organisation (e.g. the local council or common parts of a housing scheme) the value of electricity displaced can be 3-4p/kWh, depending on whether the electricity has been supplied by private wire or over the public network. If sold direct to a household, the value can be increased to around 6p/kWh while still giving savings to the householder. These options may involve additional costs, though, such as the installation of a private electrical network, as well as new billing arrangements. Any option appraisal and business plan must consider the costs and benefits of different options in order to obtain the best value for electricity generated.

The Community Energy programme has guidance on Getting best value from electricity generated in CHP in Community Heating, which can be downloaded from www.est.org.uk/communityenergy

7.4 Optimising the scheme

Financial success depends on optimising the system. This is a job for a consultant, who will need to address the following issues:

- options for selling heat. Heat meters that measure the quantity of heat consumed by buildings or dwellings are readily available. Prepayment meters reduce administrative effort and avoid problems with arrears[5]. Heat metering has several advantages:
  - charging for actual consumption is more equitable than charging a flat rate and it promotes responsible use of heat. A World Energy Council report (1991) on Community Heating states that heat consumption is reduced by 25%-35% when every consumer has a meter and pays accordingly
  - system efficiency can be accurately monitored
  - it maximises the number and diversity of customers from owner occupiers to commercial entities
- with CHP, operating hours have to be maximised to optimise efficiency. As much CHP heat as possible needs to be used on the network. Heat storage may be needed to allow the CHP unit to run when electricity prices are highest but heat demand is low
- the lowest possible network temperature is needed to: minimise network heat losses; maximise the useful heat from the energy centre; and minimise energy used in pumping
- in order to optimise heat transfer, the maximum possible temperature drop across the radiators is required. Ideally, the flow temperature should be below 90°C and the return temperature below 50°C
- network sizing involves a balancing act, taking into account future growth in the network from additional connected loads while allowing for possible reductions in energy demand as buildings improve their energy efficiency
- it is important that a Variable Volume System is specified[6]. Benefits include:
  - the lower the volume pumped, the less pump energy required
  - more stable return temperatures are more compatible with CHP
  - more stable return temperatures prolong the life of network
- damage to pipes is not normally caused by water inside the pipe, which is treated to reduce corrosion. Rather, it is due to external damage to the pipe insulation, allowing water in to corrode the pipe. Leak detection systems pinpoint the precise location of any damage to the insulation which can then be addressed before corrosion begins. Leak detection systems on heat mains should be standard

[5] Prepayment heat meters are used in the Community Heating scheme at Lynn Road, Orkney. See case study in Community Energy Programme Guidance Note A guide to new and renewable energy in community heating

[6] BSRIA Variable-flow water systems guidance AG16/2002

Table 6: Technical Best Practice checklist

Feature	Checked	Feature	Checked
Individual room temperature control		Return temperature preferably 50°C	
Independent control of heating and hot water with motorised control valves		Flow and return temperature difference greater than 25°C	
Direct connection to the dwelling		Variable speed pumping	
Hydraulic Interface Unit with sealed metal cover in each property		Pre-insulated heat distribution mains	
Differential pressure control valve and regulating valve fitted to each property		Energy management system controlling central plant	
Moisture detection alarm system in heat mains		Heat from gas engine CHP or EfW plant	
Flow temperature below 90°C			

Adopting Best Practice will ensure that efficiency levels are maximised and viability is optimised. Good Practice Guide 234, Guide to community heating and CHP; commercial public and domestic provides advice on good design practice, available from www.thecarbontrust.co.uk

8 The human factor

8.1 Involving residents

Few residents' organisations or local councillors are neutral on the subject of their communal heating systems. Either they appreciate the benefits of reliable affordable heating or else they have long experience of breakdowns and problems. In the first case, they are keen to retain these systems, while in the second they are adamant about replacement with individual boilers.

In fact the real choice is not between the old communal heating system and new central heating boilers; it is between new, modern, controllable Community Heating and new gas boilers. This choice needs clear explanation.

As residents are likely to remain in their homes during the installation phase of a Community Heating scheme, it is important to retain their goodwill. It is also good housing management practice to involve tenants when proposing changes to their homes. For housing managers, the benefits of establishing cooperation through good, on-going communication include a reduction in the risk of contract over-run, and less time spent responding to tenant concerns and queries.

Effective consultation may involve some or all of the following:

- **involvement in decisions:** this can include representation on the management board and involvement in the choice of supplier during the tendering procedure. During the design development phase, tenants can be asked about their preferences regarding controls (programmer and TRVs) and radiator type, or the location of the energy centre. Their choices can then be incorporated in the contract
- **a show flat:** suitably briefed staff can explain the heating system and its controls to tenants at open days and evenings. This should be done in advance of the main installation
- **tenant handbook:** on completion of the work, each resident should receive a clear and concise handbook explaining the system. Feedback from the consultation process can be used to make it more user-friendly. It is important that it is ready before the completion of the first property
- **information leaflets:** tenants should be kept informed. They will want to know when their home is going to be upgraded and how long this will take
- **explaining the charges:** tenants will need to understand the metering, billing and pre-payment issues

Residents and other customers need to feel confident about the scheme. A customer charter can be particularly useful in this respect. It should cover areas such as:

- back-up resources in case of problems, advance warning of planned maintenance, etc.
- how the operator will respond to faults
- how consumers connect to the Community Heating network
- issues surrounding moving home
- meter reading
- methods of payment
- dealing with non-payment, for example the installation of a card system calibrated to ensure recovery of debt
- disconnection procedures (as a last resort)
- complaints procedure
- price changes and how these will be calculated. Prices are usually linked to a basket of indicators (perhaps including inflation and the rates of other energy suppliers) in order to avoid sharp and unjustified price changes.

Figure 9: Maintaining good communications with customers is essential.

8.2 Consultants

CH/CHP projects are highly specialised areas of building services and electrical engineering. When selecting consultants to assist with the development of such projects:

- assess their previous experience in this area from project profiles
- assess the capability of key staff by reviewing CVs. Seek assurances that these staff will be used on the project
- request a list of relevant completed contracts and client contacts
- take up references
- ask about experience in tenant consultation programmes
- ask about experience in managing heating refurbishment contracts with tenants in place
- check if the consultancy has software for hydraulic analysis and CHP plant optimisation
- find out if the consultant is authorised to deliver Standard Assessment Procedure (SAP) ratings and/or is familiar with Community Heating and CHP in SAP

8.3 The 'champion'

The project 'champion' within the client organisation has been a key feature of all successful schemes. This is especially true where CHP or renewable energy schemes are involved as these can have additional complexity and there are not many examples. Champions are often well connected to a network of other practitioners, and make best use of support and funding opportunities available. They deliver a scheme even in difficult circumstances when many less committed people would have given up. They will typically adopt a solution-oriented approach, and make sure other people (such as consultants) do what they said they would do, when they said they would do it. They have senior positions within their organisation, or have the support of someone senior (e.g. the Director of Housing or Planning, or Finance, or the Chief Executive, as well as senior elected councillors).

8.4 Agreeing a strategy

Developing an agreed strategy for Community Heating will help others in the organisation understand the objectives, milestones and benefits associated with the scheme.

The benefits of Community Heating are more likely to win people over than the technology itself, and especially when those benefits are a stated objective or a statutory responsibility of the organisation (for example, delivery of affordable housing, affordable warmth or emissions reductions).

A strategy might include:

- a statement of benefits in environmental, social and economic terms
- a commitment to specific measurable objectives such as an option appraisal for specific properties or estates within a certain timeframe
- a step-by-step approach. A number of organisations have succeeded because they took developments slowly, starting with a simple project, learning from it and applying the lessons learned to the next – usually more ambitious – scheme i.e. following an evolutionary rather than revolutionary approach. In practice this has meant starting with a simple heat-only scheme and then later trying CHP or renewables
- economies of scale. Options include: using the income generated from one scheme to pay for the development of another site; bulk purchase of equipment or fuel for multiple sites; development of a business plan that covers more than one site (for example, setting up an ESCO to serve a number of sites rather than just one)

9 What next?

Housing managers can deliver environmental, social, and economic benefits by:

- retention and upgrading of existing networks
- conversion of electrically-heated dwellings to Community Heating and provision of low-cost electricity to dwellings that are likely to remain electrically-heated
- working with planners and councillors to lay out a strategy for Community Heating in new build or refurbishment and at the point of transfer of housing stock – via small scale or large scale transfer, or to ALMOs
- working with other public sector organisations such as hospitals and universities to develop an overall strategy for an area

For a housing manager, the first task is to determine what, precisely, is the opportunity for Community Heating. The next steps are to:

- identify a champion – or assume that role oneself
- convince the various stakeholders of the merits of the scheme, including senior members, both officials and elected members, and residents. This may require developing a policy, appointing consultants, conducting an option appraisal and identifying an appropriate finance vehicle to deliver the scheme

10 Further information

The diagram below illustrates the resources available from different programmes.

	Programme		
Resource	**Energy Efficiency Best Practice in Housing (EEBPH)** **0845 120 7799** **www.est.org.uk/bestpractice**	**Community Energy (CE)** **0870 850 6085** **www.est.org.uk/communityenergy**	**The Carbon Trust** **0800 585 794** **www.thecarbontrust.co.uk**
Introductory guidance	Benefits of Best Practice: Community Heating (CE13) Community Heating - a guide (CE55)	–	–
Detailed guidance	–	Financing community heating Community heating for planners and developers A guide to small scale community heating A guide to new and renewable energy in community heating Getting best value for electricity generated in community heating Connecting CHP in community heating to the electrical network	Energy Services PPP/PFI projects for community heating
Case studies	Community Heating - Aberdeen City Council Case Study (CE65) Rural biomass Community Heating case study (CE91)	Case studies on development grants awarded under CE Case studies on capital grants awarded under CE	The use of combined heat and power in community heating schemes - four case studies (GPCS370) CHP at the heart of Government (GPCS392)
Studies of the potential	–	Potential for community heating Feasibility of community heating in new build	–

Further reading

Energy Efficiency Best Practice in Housing

These publications can be obtained free of charge by telephoning the Helpline on **0845 120 7799** or by visiting the website at **www.est.org.uk/bestpractice**

BedZED, Beddington Zero Energy Development, Sutton (GIR089)
Benefits of Best Practice: Community Heating (CE13)
Community heating serves luxury private apartments (GPCS 400)
Domestic heating and hot water – choice of fuel and system type (GPG301)

The Community Energy programme

The Community Energy programme, managed jointly by the Energy Saving Trust and the Carbon Trust, has provided guidance and funding for the refurbishment of existing and installation of new, Community Heating schemes in the public secter across the UK April 2002–March 2005. In addition it offers a range of guidance on:

- financing Community Heating
- small schemes
- renewables-based schemes
- getting best value for electricity generated by CHP
- guidance for planners and developers

For further information, contact the helpline number on 0870 850 608 or visit www.est.org.uk/communityenergy

The Carbon Trust

The Carbon Trust offers professional, independent and objective advice on the potential for the use of CHP. Contact the Carbon Trust Helpline on 0800 58 57 94 or visit the website www.thecarbontrust.co.uk

Publications include:
CHP opportunities for local authorities (GPG322)
Energy services PPP/PFI projects for community heating (NPP123)
Guide to community heating and CHP – commercial, public and domestic applications (GPG234)
Small-scale combined heat and power for buildings (GPG176)
The manager's guide to packaged combined heat and power systems (GIR082)
The use of combined heat and power in community heating schemes – four case studies (GPCS370)
Using the PFI for the upgrade and extension of community heating (NPR123)

Combined Heat & Power Association (CHPA)

Grosvenor Gardens House, 35-37 Grosvenor Gardens, London SW1W 0BS
Tel: 020 7828 4077
Fax: 020 7828 0310
Web: www.chpa.co.uk
Email: info@chpa.co.uk

European standards

Pre-insulated community heating mains and fittings are covered by the following standards: EN253, EN448, EN488 and EN 489. Heat meters are covered by EN1434.

Other relevant sites include:

ODPM	Web: www.odpm.gov.uk
DEFRA	Web: www.defra.gov.uk
DTI	Web: www.dti.gov.uk
The Planning Portal System	Tel: 0117 372 6372
	Web: www.planningportal.gov.uk
CIBSE	Web: www.cibse.org
The Housing Corporation	Tel: 0207 393 2000
	Web: www.housingcorp.gov.uk
Public/Private Partnerships Programme (4PS)	Tel: 020 7808 1470 Web: www.4ps.gov.uk

Other publications include:

Contributing to sustainable communities – a new approach to planning obligations. ODPM (2003)
Energy White Paper: Our energy future – creating a low carbon economy. DTI (2003)
The Government's Standard Assessment Procedure for Energy Rating of Dwellings, 2001 Edition. This can be downloaded from the BRE website http://projects.bre.co.uk/sap2001

CE55

Energy Efficiency Best Practice in Housing

Community Heating – a guide

Energy Efficiency Best Practice in Housing
Helpline: 0845 120 7799
Fax: 0845 120 7789
Email: bestpractice@est.org.uk
Web: www.est.org.uk/bestpractice

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