



Aberdeen City Council:
a case study of
community heating

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1. Introduction

Home energy use is responsible for over a quarter of UK carbon dioxide (CO₂) emissions which contribute to climate change. To help mitigate the effects of climate change, the Energy Saving Trust has a range of technical solutions to help UK professionals build to higher levels of energy efficiency.

This case study shows how Aberdeen City Council (ACC) developed a strategic approach to community heating for existing property upgrades. It also shows how the feasibility and funding issues were addressed, and then sets out the lessons learnt.

The study will be of special interest to local authorities and housing associations.

In 1999 ACC, which has some 26,500 properties, adopted a comprehensive Affordable Warmth Strategy. Since then, ACC have upgraded a large proportion of their housing stock, whilst at the same time meeting the obligations of the Home Energy Conservation Act (1995). The improvements were mainly in heating systems, building fabric and

levels of insulation. They have contributed to achieving ACC's key objectives of affordability, sustainability, ensuring tenants' safety and reducing carbon dioxide emissions.

ACC's housing stock includes 59 multi-storey properties (4,800 units). Whilst the majority of the low-rise stock has been greatly improved through comprehensive upgrades, the energy efficiency of multi-storey properties has proved much harder to tackle. The options for high-rise properties are more limited, with substantial implications for capital expense and disruption to tenants.

ACC also have low-rise sheltered housing (1,800 units) and amenity houses (1,500 units). Amenity houses offer self-contained accommodation with the minimal level of on-site support and are normally likely to have an alarm system rather than any warden provision. Many are hard to treat or currently house people who are fuel poor. Consequently they were seen as a high priority by ACC.



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Figure 1: The Stockethill estate

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The primary objectives for these properties were to achieve affordable warmth for tenants and to reduce CO₂ emissions. The initial task was to identify the most cost effective way of meeting these objectives.

In recent years the UK Government has begun to give active support to residential community heating developments, giving rise to increased levels of grant funding. As a result, community heating has become a more economically attractive option for local authorities.

ACC decided to commission and fund an initial feasibility study into multi-storey community heating with combined heat and power (CHP) to determine whether this would be a suitable option for the multi-storey properties and how such a scheme would best be implemented.

What is community heating?

Community (or district) heating involves the use of a central boiler plant (or other heat sources) to heat a number of buildings or dwellings through a network of well-insulated underground pipes. Community heating schemes come in all shapes and sizes, from single blocks of flats to schemes serving city neighbourhoods.

By using a central boiler plant, community heating systems can benefit from competitive fuel purchasing and can utilise alternative energy sources such as CHP or renewables, including geothermal.

Combined heat and power (CHP)

CHP involves the production of electricity and useful heat from a single plant. In a conventional power station only part of the input energy is converted to electricity (typically 30-50%). The rest is wasted as heat that is lost to the surroundings. In CHP systems the waste heat is recovered to supply heat and hot water to nearby buildings. This makes CHP particularly applicable to community heating networks and overall efficiency is much higher.

2. Initial investigation into community heating with CHP

In October 2000 a feasibility report was produced by an independent CHP consultant, which examined in detail the main issues for consideration. The aim was to establish what level of funding would be available to ACC and to provide a report to present to the committee. The report also explored the

suitability of a group of multi-storey properties for a potential scheme. This group comprised seven multi-storey blocks of flats in the Seaton area of the city.

These properties were chosen because they were close together, which would reduce the capital expenditure necessary for distribution systems. In addition, their existing warm-air electric heating systems were due for upgrade in the near future. There were also seven additional blocks of flats nearby which would enable the scheme to be extended at a later date.

One of the recommendations of the report was the creation of a not-for-profit organisation to fulfil the financing requirements for the heating of the multi-storey stock. This would enable ACC to meet their affordable warmth targets much earlier than would be possible under existing council arrangements.

Whilst this initial report was used to gauge the likely funding for such a scheme, more detailed surveys were undertaken of the multi-storey, sheltered and amenity housing stock. The aim was to develop a practical long-term housing strategy for ACC and to establish the most appropriate properties to incorporate community heating.

3. Multi-storey and sheltered housing feasibility and energy study

To achieve its objectives ACC needed to gain a clearer picture of the current condition of its 8,100 properties. A team of consultants, comprised of engineers, architects and quantity surveyors, was commissioned and funded by ACC to carry out this study.

The properties were divided into groups by type and a typical building of each type was selected for further investigation. This allowed options to be considered for all buildings whilst minimising the costs of the study. The sample included 15 high-rise blocks, 12 low-rise sheltered blocks and 24 one and two bedroom houses.

Additional examination of these properties included a full structural survey, a ground condition survey and an energy audit. The purpose was to gather data relating to current building defects and to estimate the remaining life span of the building components.

From the initial surveys of all the buildings an understanding of total costs for repair, maintenance and like-for-like replacement over a 30 year period was established. This provided a useful datum for the appraisal of potential options (see table 1).

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Table 1: Projected costs for maintenance and repair of existing (8,100 units) properties over a 30 year period

Years	Five-yearly costs in £ millions						Total
	1-5	5-10	10-15	15-20	20-25	25-30	
Building costs	212.3	42.4	44.0	47.6	37.0	40.3	423.5
Mechanical & electrical costs	38.6	10.1	9.2	9.5	15	11.3	93.9
Total	250.8	52.5	53.2	52.1	52.0	51.6	517.3

In addition to the individual building assessment, an appraisal was made of buildings in close proximity to each other. This would allow consideration of connecting buildings to a centralised heating plant if they were close enough together to form a heat network. Such a group of closely related buildings is known as a cluster.

The consultants produced an original plan of 59 clusters which, following further consultation with ACC, was reduced to 35. The other 24 were considered inappropriate due to scale, geographic location and inherent infrastructure connection problems. The report identified one of the 35 clusters as the most appropriate for the development of a CHP scheme. This cluster, Stockethill, comprises 288 flats, in four multi-storey blocks. The flats had electric storage

heating, which had been installed in the 1970's. 70% of the residents of these dwellings were estimated to be in fuel poverty. The tenure of these properties was 98% council tenants and 2% owners.

The dwellings, with their existing electric heating, had an average National Home Energy Rating (NHER) of 3.3. This is a very poor rating.

All potentially viable upgrading options were considered. The options in table 2 were considered in more detail, their effects evaluated and the NHER calculated. The NHER was not, however, taken as the only criterion (see table 2).

The predicted running costs and CO₂ emissions were also calculated and considered when selecting the most effective option.

Table 2 shows that the most attractive option was CHP with overcladding of the buildings. However, overcladding would have been prohibitively expensive in capital terms for ACC. Instead they decided to opt for CHP only. This would improve the NHER to 6.0 and reduce both tenant heat costs and CO₂ emissions by approximately 40%.

4. Financing the scheme

Having established how best, technically and operationally, to upgrade the four multi-storey blocks in Stockethill, ACC needed to determine how they could finance the scheme.

Table 2: Appraisal of options

Option	Average NHER	% reduction of NHER	Total capital cost £	25 year whole life cost	Estimated running cost/ week/ flat £	% reduction in estimated running costs	Total CO ₂ emissions (tonnes/annum)	% reduction in CO ₂ emissions
Existing heating systems	3.3	N/A	N/A	N/A	5.23	N/A	1597	N/A
Upgrading electrical unit heaters (no cladding)	3.3	0	780,000	2,680,000	5.23	0	1581	1
Upgrading electrical unit heaters (cladding applied)	4.5	25	1,570,000	3,317,745	4.47	14.5	1282	20
Centralised boiler plant (no cladding)	6.5	49	935,000	2,275,589	4.15	20.5	1007	37
Centralised boiler plant (cladding applied)	7.5	56	1,630,000	2,932,540	3.93	25	837	48
CHP scheme (no cladding)	6.0	44	1,530,000	1,896,956	3.20	39	936	42
CHP scheme (cladding applied)	6.9	52	2,250,000	2,658,854	2.75	47.5	794	50

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Table 3: Total project cost = £1.6 million

Grant/loan/contribution	Amount	Source
Grant - set up funding	£50,500 (50% set-up costs)	Energy Services Programme set-up funding
Grant - capital costs <ul style="list-style-type: none"> • CHP plant • Distribution system • Internals 	£659,600 (40% capital costs)	Community Energy Programme (Defra)
Loan	Up to £1m based on capital contribution of ACC, as seen below	Bank financing
Contribution to Aberdeen Heat and Power As yet unconfirmed	£215,000 per annum	ACC EEC

Like all community heating schemes, the initial capital costs were relatively high. Without external funding ACC could only afford to fund one such scheme every 10 to 12 years and yet 59 tower blocks needed upgrading.

From the initial feasibility report it was recommended that ACC set up a separate not-for-profit company to develop and manage CHP schemes across Aberdeen.

The most appropriate structure for this company was identified by ACC staff from a number of departments. A legal agreement between ACC and the company Aberdeen Heat and Power Limited (AH&P) was then drawn up. This commits ACC to provide funding of £215,000 per year to AH&P to ensure that any bank loan taken out for capital costs can be repaid (see table 3)

The Board of AH&P consists of ACC representatives, tenant representatives and up to six unpaid independent directors with varied and relevant expertise. ACC have made it a requirement of the agreement that ACC provide a full range of financial services for AH&P, on a contract basis, during the first few years. This will give AH&P a strong start and ensure that correct financial procedures are established.

A business plan and cash flow forecast were also produced. It is intended that any surplus funds generated by AH&P will provide capital to start work on the subsequent cluster of properties.

The separate company arrangement benefits ACC by facilitating capital investment in the stock, accelerating the refurbishment programme and spreading the capital cost over several years.

ACC successfully applied to the Government's Community Energy Programme for grant funding. This was available for up to 40% of the capital costs. Due to the annual contribution of ACC, AH&P were successful in securing a favourable rate of interest for a bank loan to cover the remaining 60% of the capital. ACC have also accessed Energy Efficiency Commitment (EEC) money.

ACC has had to ensure long-term security of the tenants' heating supply and consider what would happen if AH&P were to cease trading.

The land on which the energy centre was built, and which contains the distribution network, is owned by ACC. Should AH&P cease to trade, under Scottish law their assets would revert to whoever owns the land, i.e. ACC. In addition, because the loan that AH&P took out to finance the development was underwritten and guaranteed by ACC, the outstanding loan repayments would revert to ACC. There would be no other major claim on the assets by any outside body.

5. Implementation

Having secured the Community Energy Programme funding, applied for planning permission and carried out the full tendering process, the Stockethill scheme was able to commence.

An energy centre was built close to one of the four multi-storey blocks. It houses a 210kWe gas fired reciprocating engine CHP unit and two 700kW (thermal) gas fired boilers for peak load and back-up.

The heat is distributed to the four blocks via pre-insulated underground pipes, which comprise the heat network. Each unit has a new internal distribution system.



Figure 2: The energy centre at Stockethill

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It is anticipated that 47% of the electricity produced by the CHP unit will be sold to dwellings served by the heat network and the remainder sold to other customers.

Apart from the absence of individual boilers, the heating system arrangement for each dwelling is the same as a conventional central heating system.

Mechanical heat recovery ventilation units were considered but were rejected due to the excessive disruption to tenants which would be caused by the need to remove most of the kitchen fittings.

Community heating from a central plant can keep maintenance costs down because no individual gas safety certificates need to be produced or servicing carried out. Therefore fewer visits are required to individual properties.

ACC consulted with their tenants throughout. As the process was an improvement rather than a repair, the tenants were able to choose whether or not to have the new heating installed.

Of the 288 flats, 21 tenants chose not to have the system installed. Most of the refusals were from tenants suffering from ill health who were concerned about disturbance. However, they would be given the opportunity to change their minds towards the end of the contract period. Flats

without the system would have it installed once the property became vacant.

Tenants were asked how they would like to pay for their heating and hot water. The majority voted for a flat rate weekly charge which will be paid through heat-with-rent. ACC did not initially install the new heating system in five flats with a high level of rent debt as the heat-with-rent method could have worsened the debt situation. It was decided that these cases would be kept under review and, once individual solutions to the debt problem were found (even if the debt was not cleared), the heating system would be installed.

Whilst the flats' heat use is not individually metered, ACC have placed great emphasis on providing fully controllable heating systems and individual face-to-face energy efficiency advice, including instructions on how best to use the heating system. ACC hope that this will encourage tenants not to waste energy. ACC have commissioned the CHP consultant to monitor the actual use of heat and compare it with another similar scheme where heat is individually metered to see if there is a significant difference.

It is interesting to note that by not having individual meters and charging by heat-with-rent the heating charge is exempt from VAT, helping to keep down the tenants' costs.

In December 2003 a supply of heat was delivered to the first property. AH&P will be charging ACC £4.25 per flat per week for the heating. ACC want to be sure that they will be able to meet all of those from tenants. Taking account of possible bad debts, voids and the fact that tenants only pay rent for 48 weeks of the year, ACC have decided to charge the tenants £4.75 per week. This charge will be reviewed annually to reflect actual use, debts, voids and surplus or shortfall from the previous year.

AH&P also operate a code of practice for services to its customers as is currently required of any direct energy supplier.

6. Issues for owners

In Stockhill there are only six property owners. They were consulted throughout the process and all agreed to have the heating system installed. Their main concerns regarding the upgrade of their heating systems were the capital cost and the possibility of large maintenance bills in the future.



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Figure 3: A heat exchanger inside one of the flats

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To alleviate these concerns ACC are charging them a weekly flat rate of 50 pence towards long-term maintenance costs. ACC also offered the leaseholders a loan to cover the cost of installation, the repayments being lower than their actual saving in heating costs.

There is also the benefit that ACC still 'own' the heating systems. Should any of the other properties be sold under the right to buy there will not be any problems with a 'clean title'.

7. Lessons learnt so far

From this entire process the main lessons that ACC have learnt are:

- The need to approach the process strategically.
- Whole life costing is the best way to establish the real cost and best value.
- External specialist assistance is essential.
- Due to the development workload it is advisable to delegate an individual to champion the project and keep it moving.
- An arm's length company arrangement enables acceleration of refurbishment plans.

8. The future

AH&P are already looking towards the next set of clusters as recommended in the original feasibility and energy study for the development of CHP. With the company now set up 'for the benefit of the people of Aberdeen' to develop and manage CHP schemes, AH&P will continue to reduce CO₂ emissions and address fuel poverty issues across the city. ACC Community Services staff will also continue to play an important role in identifying future projects in line with regeneration plans.

ACC applied for a 50% grant towards a feasibility study from the Community Energy Programme for the next cluster. This is the Seaton area scheme, which was used in the initial feasibility study back in 2000.

This scheme will also include a primary school and the potential to link with university buildings and a leisure complex.

For each subsequent CHP development ACC will draw up a new legal agreement with AH&P in respect of the housing element of the development. This enables ACC to keep the Housing Revenue Account funding separate from other Council budgets. If AH&P succeed in incorporating other non-domestic council buildings into a CHP scheme, a separate legal agreement will also be drawn up.

9. Further information

Combined Heat and 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

The Community Energy Programme

The Community Energy Programme, managed jointly by the Energy Saving Trust and the Carbon Trust, provided guidance and funding for the refurbishment of existing, and installation of new, community heating schemes in the public sector across the UK. The programme closed as planned on 31st March 2007. Please contact the Department for Environment, Food and Rural Affairs (Defra) with any queries on 08459 335577.



Figure 4: The Seaton cluster

Further reading

The Energy Saving Trust provides free technical guidance and solutions to help UK housing professionals design, build and refurbish to high levels of energy efficiency. These cover all aspects of energy efficiency in domestic new build and renovation. They are made available through the provision of training seminars, downloadable guides, online tools and a dedicated helpline.

A complete list of guidance categorised by subject area can be found in our publications index 'Energy efficiency is best practice' (CE279). To download this, and to browse all available Energy Saving Trust publications, please visit www.energysavingtrust.org.uk/housing

Guides

- Benefits of best practice: Community heating (CE13)
- Community heating – a guide (CE55)

Case studies

- BedZED, Beddington zero energy development, Sutton (GIR89)
- Community heating serves luxury private apartments: a case study (CE103/GPCS400)
- Rural biomass community heating case study (CE91)
- Pimlico District Heating Undertaking: a case study of community energy (CE125)

To obtain these publications or for more information, call 0845 120 7799, email bestpractice@est.org.uk or visit www.energysavingtrust.org.uk/housing

The Community Energy Programme

The following Community Energy Programme publications are also available to download from www.energysavingtrust.org.uk/housing

- Small scale community heating
- Community heating and combined heat and power
- Community heating for planners and developers
- Connecting CHP in community heating to the electrical network



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Energy Saving Trust, 21 Dartmouth Street, London SW1H 9BP Tel 0845 120 7799 Fax 0845 120 7789
bestpractice@est.org.uk www.energysavingtrust.org.uk/housing

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