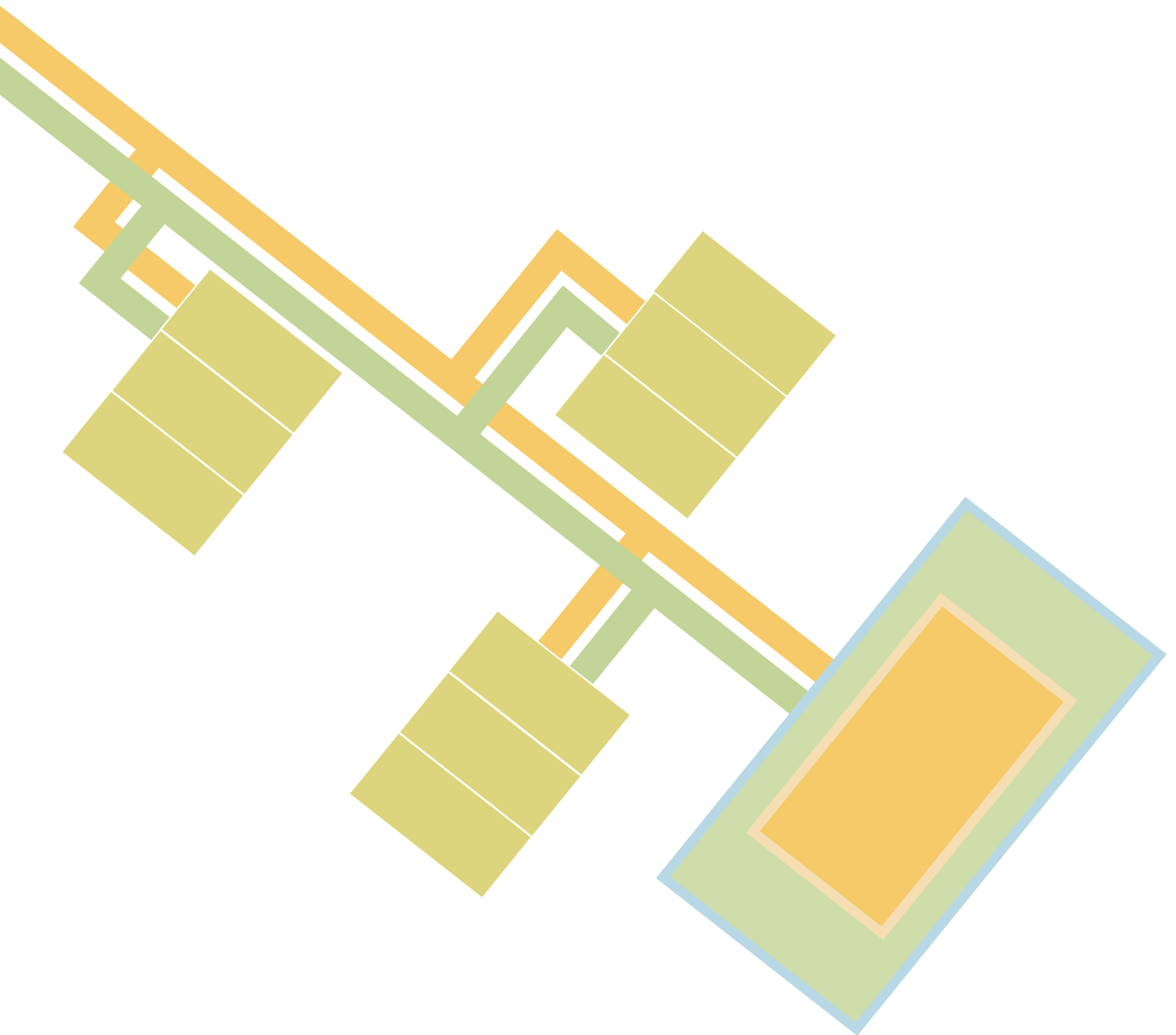


DISTRICT HEATING GOOD PRACTICE:

**Learning from the Low Carbon
Infrastructure Fund**



The Homes and Communities Agency is able to provide literature in alternative formats including large print, Braille and audio.

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INTRODUCTION

In 2009, the Low Carbon Infrastructure Fund was launched to support the development of low-carbon district heating infrastructure, and which helped local authorities to tackle fuel poverty and provide support to housing supply and regeneration. This report summarises what lessons had been learnt through the practical experience of the local authorities and developers involved. It is based on the findings from interviews with local authorities. We hope that it will help local authorities to undertake future projects.

What is the LCIF programme?

The Homes and Communities Agency (HCA) is the national housing and regeneration delivery agency for England. Its role is to create thriving communities and affordable homes. The HCA works nationally but supports the ambitions of local partners.

The HCA's Low Carbon Infrastructure Fund (LCIF) was launched in 2009 as part of the Government's Housing Stimulus Package. The initiative was a partnership of Department of Communities and Local Government (DCLG) and Department of Energy and Climate Change (DECC) and the HCA. Its purpose was to support the development of district heating (DH) infrastructure as part of the delivery of new homes and the refurbishment of existing housing stock.

The funding was focused on housing growth areas in England and bids were sought from local authorities (LAs). The fund had £26m to administer and allocated £21m to an initial tranche of 13 projects. An additional £5m from DECC from November 2009 enabled the support of an additional three projects which are still in the pipeline and are not the subject of this lessons learnt report.

The projects included in this report are:

- Cranbrook New Community, East Devon County Council
- Greenwich Peninsula, London Borough of Greenwich
- Cranston Estate, London Borough of Hackney
- Manton and Reynolds Towers, Birmingham City Council
- Milton Keynes, Milton Keynes Council
- Riverside Dene, Newcastle City Council
- The Hub and Southside, Nottingham City Council
- Wood End, Henley Green and Manor Farm (WEHM), Coventry City Council
- Mayflower Gantry, Southampton City Council
- Woolston Riverside, Southampton City Council
- Yarn Street, Aire Valley, Leeds City Council
- Cambridge and Crescent Towers, Birmingham City Council
- Hanham Hall, South Gloucestershire District Council

All of these projects demonstrate how, in the right conditions, DH can achieve CO₂ savings in meeting the demands for space- and water-heating in existing and new buildings. Details on the specific projects can be found in the **Case studies**, starting on page 14.

The LCIF programme has allocated all of the funding available and is closed to further applications. However, the HCA will continue to support projects of this nature through their land and property function, particularly in respect of affordable housing. Where developments are of sufficient scale, the HCA will bring forward site-wide energy solutions that meet the Code for Sustainable Homes (CSH) criteria.

Achievements of the programme

When all 13 projects have been completed, the LCIF programme will have:

- delivered 52,598 tonnes CO₂ per annum reductions;
- connected 24,167 existing and new-build homes, all of which are Code for Sustainable Homes level 3 or above, with most hitting Code Level 4 (CSH Code Level 6+ at Hanham Hall);
- used five different heat generation technologies;
- worked with six different energy providers.

The programme was a practical applied fund providing capital support to test a range of decentralised heat generation technologies and approaches. In addition to the positive outcomes outlined above, the programme has also been able to:

- create better links between civic, commercial and housing heat loads and demand, for example at Nottingham, where several interests are joined together by the scheme;
- act as a proving ground for private investment in the UK's growing DH market. The programme has proven that even during difficult market conditions there has been some confidence and activity in DH, with companies willing to invest and even grow the offer beyond schemes that benefited from funding;
- provide better information and help to disseminate good practice leading to greater efficiency, for example, encouraging dialogue between LAs experiencing the same problems and helping to find common solutions;
- help examine the best routes to a low-carbon economy including evidence of what works in different situations and contexts.

What is in this report?

This report has been compiled to provide the lessons learnt from the LCIF programme. The projects were supported by a dedicated team within the HCA, as well as regional HCA scheme managers. The report draws on experience developed by these personnel through their management and operation of the programme, from interviews conducted with local authority project managers and from ongoing monitoring of the schemes' performance. It presents information gathered from the programme to support the future development of DH networks, of all types and sizes, by LAs and communities across England. The report consists of three main sections:

- **Benefits of district heating:** low-carbon energy technologies are location-specific and no one technology is a panacea. DH will only be appropriate in certain circumstances, but where it is appropriate, it can offer a number of benefits; these are detailed on page 4.
- **Key lessons:** the report synthesizes the lessons learnt from projects across the programme to provide clear messages about the challenges of the development process to help LAs, and others, smooth the development and delivery of future projects; these are offered on page 5.
- **Case studies:** whilst there were generic lessons to be learnt, each project faced its own particular challenges and these are detailed in the case studies on page 14.

BENEFITS OF DISTRICT HEATING

As well as delivering on the core objectives of the local authorities involved, district heating was found to provide many other benefits, which are outlined here.

This report recognises that a variety of local factors influence the strategic priorities of a community or council across the UK. For some, the priority might be reducing emissions while, for others, it may be the benefits in terms of reducing fuel poverty.

Used in the right conditions and engineered in the right way, DH has the potential to provide benefits over and above the incumbent heating technology, including individual renewable alternatives. Many LAs, led in part by those involved with the LCIF programme, are seeking to understand better the feasibility of DH for their areas. The core objectives for LAs bidding to the LCIF programme for funding were to: reduce carbon emissions; increase renewable capacity; increase the sustainability of the development; reduce fuel poverty; and manage waste.

Diversity of supply opportunities

DH networks allow operators to choose from a number and range of low-carbon heat sources and heat generating technologies. Networks can be designed to best suit the needs of the local community, taking account of space constraints for example. They also enable developers to take advantage of local opportunities such as the close proximity of biomass supply or existing heat distribution infrastructure.

Scale

By connecting different heat loads, DH networks can access heat at a size and scale that would otherwise be inaccessible – for example, taking waste heat from power generation. Though not represented in the LCIF programme, the networks which are being developed will form a solid and economic base from which larger networks can grow, ultimately connecting to larger thermal power plants more commonly located away from high heat density areas. Heat networks can also access technologies with higher efficiencies than are available to individual buildings.

Lower operating and maintenance costs

Operating and maintenance costs shared between many consumers often deliver lower costs through economies of scale compared with traditional heat supply arrangements.

Lower heat generation costs

A diversity of customer types, requiring heat at different times of the day, can be connected, resulting in a smoother heat-demand profile, which can increase efficiency, lowering the cost of heat production. It can also reduce wear-and-tear on boiler and Combined Heat and Power (CHP) plants, leading to lower costs and greater longevity.

Future-proofing

Though expensive, DH pipes have a long lifetime, often more than double that of any boiler, when adequate maintenance processes are employed. It is also technology agnostic; any means of heat generation can heat the water in the pipes, giving flexibility over future changes in heat technology or fuel source without changing the system. This is important in the longer term as the UK moves from gas to more renewable forms of heat supply.

Benefits for communities

An increased sense of community is fostered through the shared use of low-carbon technology, as was found by Hackney Council at the Cranston Estate; whereas in Cranbrook, the use of locally-sourced biomass contributed to the local economy. At Riverside Dene, DH now contributes to affordable warmth, local carbon savings, and assists in meeting renewable energy targets. It also permits the LA to part-own the energy company, opening up a potential revenue stream.

Heat networks can also improve the resilience of energy supply, giving greater control over energy services to local energy authorities and their communities. Networks can also expand, connecting new building developments as well as existing buildings. Nottingham has extended its existing network to serve new and existing buildings in both the Hub and Southside, and the Meadows and Eastside projects.

Lower-cost energy can also help to retain wealth within the local economy and contribute to its economic vitality. Decision-making is devolved to a local level, closer to the point of impact, making it more sensitive to local issues. In some cases, control by community groups or local interest organisations can be achieved, either through governance, or part ownership, or a mix. Such issues are being considered by Hackney Council. Although it is important that operation and management are undertaken by a professional DH company.

Benefits for developers

DH can help developers meet planning obligations and achieve high levels of the Code for Sustainable Homes through the provision of site-wide solutions, such as at Yarn Street, Leeds; and can harness renewable heat, for example at Cranbrook, Riverside Dene and Milton Keynes. Developers may also benefit from an improved reputation with LAs and other development parties by assisting them in meeting carbon and renewable targets, leading to greater development and commercial opportunities. Financial benefits include:

- enhanced capital allowances for CHP schemes;
- reduced liability under the Carbon Reduction Commitment (CRC) programme;
- access to revenue support mechanisms such as the Renewable Obligation and Renewable Heat Incentive.

DH also provides developers with greater design flexibility, as Hydraulic Interface Units (HIUs) take up less space and can be located anywhere within a building – they don't need to be on an outside wall because external flues are not necessary.

Benefits for occupiers

Users taking heat for their home through a modern heat network will experience virtually no difference from a normal gas boiler. Controls are the same, if not more advanced, with accurate individual heat meters. There is additional space since the HIU is smaller than a boiler and can be mounted anywhere, and there is no requirement for hot-water cylinders.

KEY LESSONS

This section represents lessons learnt by local authorities on all aspects of the development process. All of them are taken from the practical experience of the local authorities of the 13 case studies in this report.

1 Main lessons learnt

1.1 Defining objectives

Before commencing a project, it is necessary to decide what objectives it has to deliver. They could be carbon emission reductions, affordable energy or security of supply. Each local community will have different needs and priorities and it is important to engage with the community through local groups and organisations in order to identify their preferences. For example, Birmingham City Council undertook initial resident consultation, which was carried out in 2006, before the blocks were upgraded in 2007 as part of Decent Homes.

From such engagement it will be possible to determine the project's objectives. These will need to be agreed and endorsed by all project partners, including developers. The project can then be designed to achieve the set objective/s, but needs to be continually reviewed to ensure that it is on course and not subject to 'mission creep'.

Once projects are identified and their objectives established, undertaking financial and technical feasibility studies is critical to their success. Typically, these processes will define the actual buildings to be connected. It is important that any staff or consultants (technical, financial and legal) and contractors engaged have appropriate expertise and track records in the design of DH. At this stage, it may be useful to engage with specialists in designing the project.

However, it is also imperative that advice or feasibility assessments are undertaken cost effectively; there are good sources of help and support available for free, and prospective schemes should be careful not to spend money on expensive contracts before the potential benefits of the project can justify it. It can pay to seek advice from public sector sources, including Community Energy Online (CEO), the Energy Saving Trust (EST), the Carbon Trust or relevant trade associations active in the field, such as the Combined Heat and Power Association (CHPA).

1.2 Familiarity with the market

Whilst consultants can design a conceptual project, at some point it will have to move to real delivery. This could be constrained by what is available and deliverable in the current commercial energy services market. Consequently, the LAs within the LCIF programme found that it was beneficial to undertake early engagement with the commercial energy and utility market, including mainstream energy companies as well as energy services companies (ESCOs), in order to understand what they can provide and which are suitable for the scale of the particular project. Smaller companies may offer flexibility and have the appropriate expertise but may lack the financial strength to take on larger projects. On the other hand, while larger companies may have the scope to take on larger projects, for example 5,000 dwellings and above (and a better ability to handle risk), they may need to sub-contract particular aspects of delivery to smaller, specialist companies.

Where new-build development is being undertaken, it is critical to have a knowledge of commercial models used by housebuilders, and how they interface with the financial models used in the energy market. This is vitally important for the allocation and management of risk. For example, energy companies will expect housebuilders to make a contribution equal to the cost of traditional heat supply systems. Additionally, energy companies cannot control the rate of build out and will expect housebuilders to manage this risk. It is also likely that a housing developer, for example, will want to exit a scheme much earlier than a utility partner (ie build the properties, sell them and move on); this means the utility partner will have to carry the operational risk into the future. At Yarn Street, Leeds, the partners intend to sell the project on at a later date but, in the meantime, the council is carrying the risk under State Aid rules. Multiple public and private partners also increase the complexity of projects. The project team at Southampton, Woolston Riverside reported that "this made complying with State Aid rules challenging in determining which party should carry risk".

Market engagement can present risks to public sector organisations in complying with public sector procurement procedures. Newcastle and Nottingham City Councils both reported on the challenges they encountered in procuring a contractor whilst remaining compliant. Therefore, care must be taken in early engagement or soft market testing to avoid impacting on public sector obligations under such procedures, and running the risk of challenge.

1.3 Experience of project partners

The LAs and their commercial building development partners participating in the LCIF programme varied in their experience of DH technology. Some LAs, such as Nottingham City Council and Birmingham City Council, who were extending existing networks, were well versed in DH, while others, who were establishing new networks, were engaging with the technology for the first time.

On one hand, there was a lack of understanding among LAs of the commercial energy sector. LAs also lacked knowledge of the technical and feasibility development process necessary for the delivery of a DH project. A key difficulty was managing the uncertainties of the long-term commitment(s). For example, Coventry City Council experienced protracted contractual negotiations because of their inexperience with energy projects and markets. On the other hand, there was a lack of knowledge among energy sector companies of planning policy and LA decision-making processes. The Cranbrook project team in Exeter reported that, "difficulty was experienced in matching planning with the commercial requirements of the ESCO. At Riverside Dene, Newcastle City Council carried the risk of the planning application instead of the contractor."

Misunderstandings from this lack of knowledge gave rise to a slow learning process, which led to delays.

1.4 Establishing roles and relationships

All LAs within the LCIF programme found that the work required for the successful implementation of a DH scheme is extensive and complex and should not be underestimated, particularly if it is part of a wider regeneration project. Birmingham City Council experienced significant difficulties in marrying the DH project to an adjacent Building Schools for the Future (BSF) project and wider area regeneration. Retrospectively, they believed the project would have benefited from a jointly-appointed project manager. Therefore, LAs embarking on the development of DH schemes should understand that they are taking on a significant challenge. This will be eased if roles and relationships are clearly identified and established.

Key players need to be involved early and at board level in order for a project to achieve the necessary momentum. As the project evolves, there is a need for constant reaffirmation for and by these players. The project board established for the Riverside Dene project is a good example. Additionally, existing communities need to be engaged and kept fully informed during development to avoid misunderstandings and delays. Riverside Dene appointed a tenant liaison officer to handle community engagement, which was well received and ensured tenants were kept informed of developments which might affect them. Delivery teams need to be kept fully briefed to ensure the process runs smoothly, and project champions should be identified and appointed to drive the scheme forward.

1.5 Engaging in delivery

The complexities of delivering a DH project inevitably throw up a series of challenges; it is important that project champions are not overwhelmed or deterred by such challenges, or view them as 'showstoppers'. Rather, partners and delivery teams should be creative about solutions. This was evident in all projects supported by the programme, even for those councils with experience of the technology and existing ESCO arrangements. Projects with multiple stakeholders and partners, such as Cranbrook, were particularly challenging and required innovative thinking by the project team. Often starting from a position of having no previous experience, many individuals from LAs involved in the programme are now exceptionally proficient in the delivery of these types of energy system and in managing the many different parties and risks involved. LAs and organisations considering developing DH projects would benefit from discussions with these and other people who have been through the process – contact details for many can be found in the case studies at the back of this document.

Another important element is placing the risks involved with the party who can exercise most control over them and be very clear about defining roles, responsibilities, ownership, risk and liability. For example, at Birmingham's Cambridge and Crescent Towers there is a clear distinction between the operation and maintenance of the DH network carried out by the Birmingham District Energy Company, and the infrastructure within the blocks, which will be managed by the council's housing department. The project team at Greenwich Peninsula found this is vital to creating the certainty and confidence needed to succeed with joint projects of this kind.

Regeneration programmes, including estate renewal schemes, should plan to integrate low-carbon infrastructure from an early stage. Masterplanners, architects and contractors need to be fully briefed and informed to take account of such interface and integration issues, with clear project plans to guide development. For example, the energy centre at Manton and Reynolds Towers, Birmingham, was designed and built to accommodate plant sufficient to supply the school and did not take account of the need to supply the blocks as well. Fabric

improvements to existing buildings or fabric specifications for new buildings also need to take account of the requirements of DH schemes to avoid problems such as overheating, in particular ensuring appropriate insulation of risers and lateral distribution pipes.

While the substitution of HIUs will remove the need for flues from individual dwellings, providing design flexibility for developers, the need for stacks will have to be incorporated into the design of energy centres, taking account of location and planning requirements. This was a particular issue at Riverside Dene, Newcastle. Energy centre design will also need to plan for future growth of schemes by allowing space for additional plant and equipment.

Taking such an approach will enable LAs to follow the lead established by other authorities, including those benefiting from the LCIF programme, in establishing successful projects that deliver the objectives set out for them.

1.6 Legal complexities

Lengthy and complex legal procedures, such as reaching contractual agreements, were a significant challenge for many of the project partners under the programme. For Coventry City Council, "key issues that caused problems were the contractual negotiations between various parties".

Many suggested that standardised documentation, such as model contracts, would be helpful, and LAs or communities seeking to develop networks of their own may benefit from talking to others with similar characteristics to see if there are common contract terms which can be replicated. The cost of legal services was also an issue for some. It was felt that employing legal experts with experience of the energy field early on was useful, particularly for large or complex projects. Newcastle City Council, for example, found ready access to experienced legal experts invaluable, whilst Hackney Council found thorough briefing of in-house legal teams was essential to success and being in a position to meet deadlines.

1.7 Cost of external support

It is necessary to identify and clarify what can be paid for in project management fees, since an element of funding should be made available to cover the cost of any external support. In larger schemes this might be even more substantial in terms of technical feasibility studies and legal and financial advice costs. As a general rule of thumb, development costs will account for approximately 10% of capital expenditure.

1.8 Experts and documentation

Project partners suggested that it would be useful to have ready access to experts in the field. The LCIF programme's technical experts and regional project managers were regarded by the LAs as extremely helpful for the deployment of these schemes, especially for those that had no experience in DH.

2 Pre-development planning and development stage-related lessons learnt

Some LAs within the LCIF programme lacked knowledge of the technical and feasibility development process necessary for the delivery of a DH project. However, the development of most DH projects follows a similar trajectory which can be broken down into a number of specific stages, as set out in a recent report, *Community Energy: Planning, Development and Delivery*, King and Shaw, 2010 (see Figure 1, below). The stages are necessarily interdependent and iterative, and problems may relate particularly to one stage or to overlapping stages. Projects supported by the LCIF programme broadly followed this trajectory, but not necessarily mirroring the stages exactly.

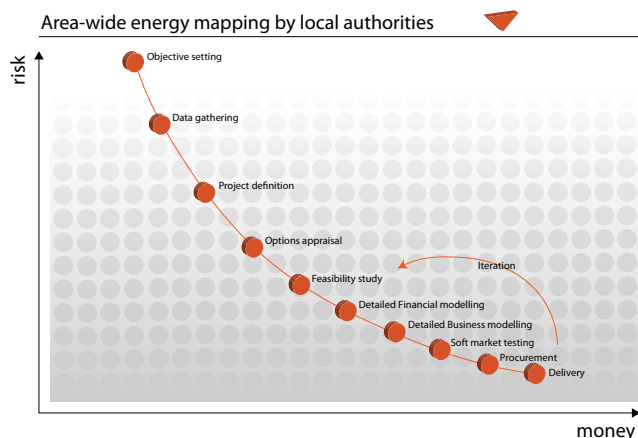


Figure 1: The 10 stages of the project development process, or 'flightpath'.
(Community Energy: planning, development and delivery 2010)

Establishing objectives: LCIF scheme, Cranbrook New Community, Exeter

"Cranbrook received initial consent [for the project] from East Devon District Council (EDDC) in December 2007. Supplementary planning guidance had been issued with a 30% renewable target. However, this was not enforceable and EDDC negotiated a consent that committed the New Community Partners to Code for Sustainable Homes Level 3 and 16% of total energy from renewable sources. The developers proposed that the renewable generation required be met from wood pellet boilers in the commercial properties... The process of setting sustainability targets (even if not enforceable) is important for developing officer and member commitment to the sustainable development agenda in a local authority. Third sector organisations can play an important role in this process."

Fliss Morey, Projects Director, Exeter and East Devon Growth Point

2.1 Setting up the project

In order to develop a DH scheme, a LA needs to establish its objectives at the outset. These may include tackling fuel poverty, reducing the development's CO₂ emissions, meeting local or national targets for emission reductions, or developing supply diversity and security.

LAs have a crucial role to play in facilitating, encouraging and delivering low- and zero-carbon initiatives. However, constraints on public sector funds mean it is often necessary to attract external private investment; as private sector interests are not always the same as public sector objectives, this can

result in protracted negotiations and complex legal contracts, jeopardising the ability to achieve desired outcomes.

Many of the projects experienced significant challenges in achieving agreement between partners on project objectives. For example, there may be a conflict between the desire to meet legal CO₂ emission reductions targets and also deliver the investment returns required by private investors. In particular, housebuilders that were unfamiliar with the technology often had concerns regarding the marketability of properties. This was compounded by the existence of any policy uncertainty, and it was found that fixed targets for example for reducing emissions, such as through the Code for Sustainable Homes, or as set by planning authorities under the planning framework, can provide the basis for agreement of the project's objectives.

One example, related more to social perceptions than technical feasibility, was the lack of gas supply to cookers in new-build schemes where DH replaced the need to service the site with gas mains. This highlights the importance of working with the developer to consider how the homes will be marketed, for example, will induction hobs be provided in show homes, and how will reasons for lack of gas within the home be explained to the consumer? These issues are important to the success of the scheme, and fall outside the technical feasibility.

Agreeing strategic objectives between partners at an early stage is essential, as reported by the Greenwich project partners, for example, who found "the management of the project [to be] a balancing act between public sector and private sector interests". The Southampton Woolston scheme reported that "the formation of contracts with [the] private sector was the hardest part".

Many of the projects found the establishment of project boards and operational delivery teams involving key players facilitated the securing of common objectives and smoothed communications between the parties.

While setting the objectives for the specific project is vital, it is important that these are embedded in a broader vision for the area. This will enable the project to be linked to future opportunities developing elsewhere. The partners in the Yarn Street project, Leeds, pointed out that they achieved feasibility on a small-scale, but that "to make a significant sustainability solution, councils need to take a strategic approach, preferably for large-scale provision across a wide area..."

In determining whether a DH scheme is appropriate and can deliver the objectives, it is necessary to establish its technical feasibility. The information can be presented very effectively in a heat map (see Figure 2 on page 8). The process starts by gathering data on existing and future energy consumption and the density of existing or proposed buildings, along with potential energy sources and the advantages and disadvantages of the particular location in terms of distribution, transport and so on. The demand diversity between domestic and non-domestic consumers must also be established, along with identifying potential anchor loads to provide the cornerstone of the development.

The scale and extent of the DH project need to be defined in detail by identifying the buildings to be connected. The outline project will need to be presented to stakeholders, particularly the owners of the buildings identified, to secure their support to initiate the project and to take it on to the later stages. It is crucial that this initial scope involves experts with relevant expertise and track record in the design of heat networks.

Early on, it is also worth considering the various permissions required to proceed with the project, from planning and building regulation issues to wider regulatory considerations, such as State Aid. In particular, the planning system can help facilitate the development through use of mechanisms such as the Community Infrastructure Levy and/or Section 106 obligations, which, with a sound evidence base,

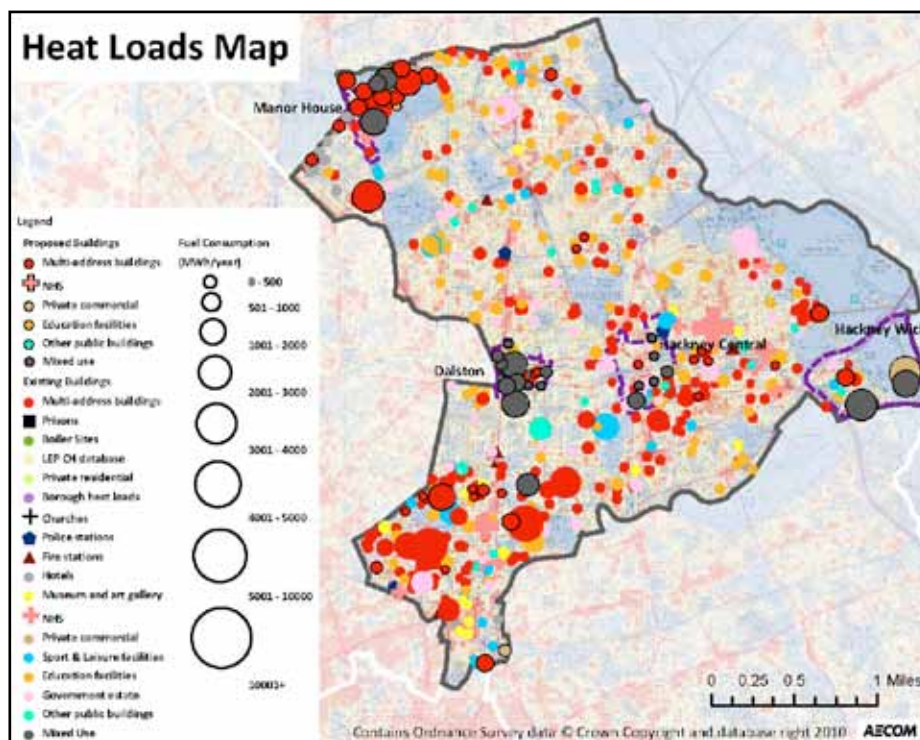


Figure 2: Heat loads map of Hackney. A heat map is a useful tool in determining the best location for a DH network. It shows the existing and potential heat supply, demand and network opportunities across a given area, including energy sources and potential anchor loads.

can provide a financial contribution to an infrastructure project, or a payment-in-kind, such as land or buildings which can be used for locating lower-carbon energy infrastructure.

When seeking permission, it is often advantageous to make local authority planning officers and members aware of the proposals early on and include them in pre-application discussions. This can considerably speed up the process of ensuring high likelihood of compliance with statutory planning regulation; help tailor the scheme to fit other local policies such as Local Enterprise Partnerships, which often include elements of supporting infrastructure; and build up community support in advance of a more formal decision-making process through the planning system itself.

Of particular importance here, as most DH is site-wide or area-wide in nature, is its integration with strategic planning and urban design. Energy opportunities planning studies should be commissioned alongside other future planning work streams (eg education provision, waste management, water provision and management, transport, housing capacity and so on) and integrated with them.

These skills (both inside and outside of the LA) should be harnessed early on during the masterplanning phase of the scheme, and can influence the outcome. For example, wide streets used as a focus for retail interest can also be ideal for a public transport corridor or waste collection points, and can be co-located within infrastructure trenches that include services for DH. The design should inform the heating system and vice versa at this stage, so that an integrated services approach means that services complement each other, strengthening the business case for each of them, or, in some cases, providing cross-subsidy so that it is viable as a whole (eg energy profits contributing to green space management, or green space used in part as an energy crop for supply), as well as, importantly, providing a high-quality outcome in terms of place making.

London Borough of Hackney

“The project brief must be written by someone with extensive knowledge of Combined Heat and Power who understands the end goal, i.e. ensuring that the first phases do not restrict the entire project outcome.”

Anna Eager, Project Manager, London Borough of Hackney

2.2 Building support for the project

All low- and zero-carbon technologies are location-specific. Whether DH is an appropriate option will be determined by the characteristics of a development or regeneration site in terms of its phasing, building typology, spatial arrangement and infrastructure, and what fuels are available. The key determinants are:

- building density;
- diversity of consumers;
- presence of anchor loads.

These things, in particular, should be taken into account in an options appraisal to determine whether DH is the appropriate technical solution.

Having identified DH as the appropriate technical solution, a specific energy study will be required to develop solid technical and financial evidence for the DH project. This should include detailed analysis of:

- the age and efficiency of the buildings;
- phasing (for new developments);
- measurements, including length of network, height of buildings and so on, to calculate the temperatures and pressures needed for the network;
- network heat losses;
- type and scale of connections;
- land availability;
- thermal storage to supply a buffer to the system and reduce heat dumping;
- potential to combine heat and cooling on the network;
- volatility of future energy prices and likelihood of gaining some control locally.

Other things to consider are the size and number of boilers, types of fuel/supply chains, and future-proofing (allowing for future expansion of the network and exploitation of advances in technology and alternative fuels). The Cranbrook project, Exeter, reported the benefits of a specific energy study: “the energy strategy developed solid technical and financial evidence which made the case for low-carbon development.”

Cranbrook New Community, Exeter

“Commission the appropriate area-specific energy study (taking the necessary advice on the brief) to develop solid technical and financial evidence, and then communicate the results widely.”

Fliss Morey, Projects Director, Exeter and East Devon Growth Point

In undertaking a specific energy study, it is important to engage technical consultants with appropriate expertise and track records in the design of DH. Although consultants can design a conceptual project, innovative technical solutions within the design can prove difficult to implement in practice. For example, in Milton Keynes, ‘anaerobic digestion-derived gas’ did not comply with UK gas protocols concerning injection into the National Grid. This matter has been referred to Ofgem for determination.

Lack of technical experience of DH design in the UK led to confusion over certain methodologies. For example, at Manton and Reynolds Towers, Birmingham, there was a difference of opinion amongst technical advisors on the methodology to determine diversity factors when calculating maximum heat load. A revised British Standard is being developed by the British Standards Institution to address this problem.

Projects benefited from the HCA/LCIF programme management and regional HCA project managers, who were able to offer advice on addressing problems which arose. They were also able to provide connections with key personnel in Government departments and other agencies, such as Ofgem, as well as external experts.

2.3 Getting the project going

Not only does a project have to be technically feasible, it must also be financially viable. This typically requires development of a cumulative cash flow model which shows capital and operating costs for the project, as well as revenues from heat and electricity sales, together with any support mechanisms, such as the Renewables Obligation and, in the future, the Renewable Heat Incentive. As the model will be making assumptions about future cash flows, it is important that discounted cash flow methodology is adopted. DH includes costs not common to conventional heating but is also able to avoid costs incurred in relation to, for example, annual boiler maintenance in individual properties or the need to find alternative (potentially more expensive) forms of reducing carbon emissions (depending on the requirements set by the local or planning authority). These costs/benefits should be captured by using ‘whole-life costing’ methodology.

Theoretically, the revenues over the term of the project should cover operating costs and provide a reasonable rate of return for investors of capital. Different types of investors have different expectations of the rate of return they require. This is reflected in the Net Present Value (NPV) rate adopted. As public and private sector investors have very different NPV rates, this, in turn, means you need to consider how the different investment streams are organised in the business model you plan to adopt for the delivery and operation of the project.

2.3.1 Engaging with ESCOs

LAs supported by the LCIF programme had a varied experience in engaging with ESCOs. Those that had existing experience of DH tended to have established ESCO relationships and experienced little difficulty.

While those LAs without established ESCO relationships recognised that either wholly-owned public sector or public/private ESCOs would provide them with greater control, they also realised that the establishment of such models is complex and time-consuming. Most LAs supported by the programme, such as Cranston, Hackney, did not feel able to develop such business models within the timescales of the programme. In addition, they felt it was not their area of expertise and it was difficult for them to calculate a project’s revenue streams when taking into account support mechanisms specific to the energy sector, such as the Renewable Obligation and the Renewable Heat Incentive.

As a result, most projects initially sought to tender the development of the project to private sector ESCOs, as it was less time-consuming than public procurement processes. In addition, LA project managers were also more familiar with this approach. Some projects sought to avoid public sector procurement processes by engaging an ESCO via a private sector partner, such as a housebuilder or contractor. This resulted in complex contractual negotiations, as in the cases of Manton and Reynolds Towers, Birmingham, and Wood End, Henley Green and Manor Farm, North Coventry. Ultimately, this approach was abandoned, losing valuable time for the projects.

A further dimension was scale. ESCO solutions tend to be site- or situation-specific. Smaller projects had difficulty in securing commitment from private sector ESCOs, as they were not of sufficient scale to warrant investment by them, although the flexible approach of some ESCOs helped. Smaller energy services providers found raising finance much harder. However, partners in large projects found they had to engage with large ESCOs as these had the ability to resource larger projects. The project team at Cranbrook found that “a site-wide, low-carbon energy solution ... would probably need to involve a major energy player that had the financial strength to commit the large amount of capital involved”.

2.3.2 Risk management

A primary objective for the LCIF programme was to support the projects while developers and other stakeholders addressed issues including re-arranging the physical aspects of projects, re-allocating the risks, or adjusting the business model to increase public sector risk exposure and identify an acceptable internal rate of return (IRR). It was an iterative process to identify the balance of risk that was acceptable to all parties. In Figure 3, below, project managers initially sought to tender their project to the commercial market but found the project was too small to deliver acceptable returns for commercial ESCOs. On

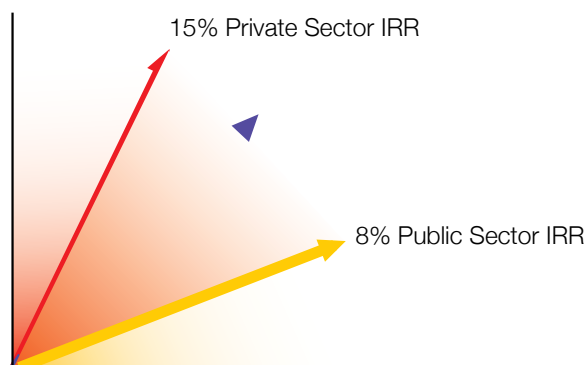


Figure 3: Parameters of financial modelling

adopting an alternative public sector model, it was found that senior managers were not comfortable with the level of risk. A hybrid model was therefore developed that shared the risk and provided a medium level return. Though ultimately effective, this process absorbed considerable effort and time.

Key elements that must be determined within the business model are:

- the level of risk different parties are willing to carry;
- the amount of control over the project required by them.

While a general rule is that risk should be allocated to the party best placed to manage it, where it eventually resides and the control exercised over it, will affect the cost of capital and the overall rate of return for the project. For example, in a given locality, private sector ESCOs will be attracted by anchor loads that provide them with a high proportion of the required rate of return. They will be less interested in low-value areas with, for example, a prevalence of fuel-poor households as well as new-build projects that carry a high degree of risk associated with phasing and build-out. LAs, on the other hand, may wish to control development of a project in order to determine which buildings or areas should be connected, the selling price of heat and the type of energy source. If the finance is raised through the private sector ESCO, however, or if risk is transferred to it, then the degree of control by the LA will be reduced.

These tensions need to be resolved in the development of the most appropriate business model, and adjustments may need to be made to the approach adopted at the outset.

Specific risks identified by LAs supported by the LCIF programme included:

- The lack of experience, skills and capacity in the UK for designing, developing, installing and operating schemes, which increased the risk of unexpected cost rises, delays and poor contractor performance.
- Uncertainty and complexity of the legal position and *vires* of LAs.
- Continuing policy and regulatory uncertainty leading to reluctance to adopt a long-term technology option. For example, Birmingham City Council reported that the Manton and Reynolds Towers project had to change its energy supply provision due to a change in policy. Nearby Holte School was intended to receive BSF funding to retrofit the school building, including the construction of the boiler house for both projects, but this didn't happen because of policy change.
- Complexity arising from the difficulties in achieving the collective decision-making necessary for DH, and securing the long-term commitment required. For example, Coventry City Council reported: "Key issues that caused problems were the contractual negotiations between various parties and, as this is a relatively new area, (they) became overly protracted."
- Most DH schemes are natural monopolies and there was concern over potential monopoly abuse of customers.
- DH developers faced considerable market risk in securing commitment from multiple building owners, who are more familiar with a competitive energy market. This may cause difficulties in obtaining finance for the network. It can be mitigated by local planning policies that oblige developments to install heat networks, and by public sector buildings committing to a scheme in order to meet their wider obligations on climate change mitigation. These provide opportunities to establish an initial heat demand to underpin the network.

- DH is a capital-intensive technology with a long life and long payback periods. Financial returns can be modest and achieved only in the long term. Financing such projects is challenging, requiring longer-term financial models and/or innovative financing mechanisms.

Funding complexity: Hackney's Shoreditch scheme

"The complexity of the funding mechanisms required to deliver the project (ie between London Borough of Hackney, the Homes and Communities Agency, potentially the London Development Agency and CESP) have led to significant and onerous processes with each funder/potential funder seeking its outcomes and audits."

Anna Eager, Project Manager, London Borough of Hackney

Synchronising development timelines, including securing sign-off for the project at the appropriate level within an LA as well as within a potential private sector ESCO, poses significant risks to delivery. This may require several successive meetings, and instigating and complying with appropriate procurement processes.

A delivery plan, including key milestones, must be prepared for any energy development project. Responsibility for contract supervision should be allocated to an appropriate individual within the LA so that there is a continuous link between the different parties, to ensure progress is kept to timetable and so that any problems that arise are dealt with quickly. LAs supported by the LCIF programme reported the following risks to the smooth operation of delivery:

- Time required in obtaining and assembling information on land ownership, energy consumption in existing buildings etc.
- Phasing issues – as new-build development is affected by fluctuations of the property market, this will determine the rate of build-out, posing risks to the project if timelines get stretched too far.
- Obtaining planning permission for the energy centre.
- The time lag between the evaluation of tenders and the appointment of contractors or external ESCO provider.
- Legal negotiations – these can be facilitated if the internal legal team is familiar with the energy and property market, and is thoroughly briefed well in advance.
- Long lead times for ordering key technical plant.
- Time required for testing and commissioning the plant and equipment.



© Newcastle City Council

Thermal storage tanks at Riverside Dene, Newcastle.

3 Lessons learnt by local authorities, for local authorities

3.1 Establish a delivery team

LAs recommended the establishment of a delivery team to co-ordinate and manage the process that reflected the size and scale of the project. Nottingham City Council recommended, involving “a broader cross-section of internal staff in the bidding process as their experience and input could tease out potential pitfalls”.

3.2 Be aware of funding opportunities

Authorities should be alert to a wide range of funding opportunities. For example, Hackney Council was able to combine spending under their capital budget with grant funding from the LCIF and the Community Energy Saving Programme, as well as a grant from the London Development Agency. It is helpful to establish links with Government, trade associations and others to be aware of the full range of funding that may be available, including potentially from Europe.

3.3 Allow enough time

Authorities advised that in order to leave room for contract negotiation, at least eight months should be allowed to secure planning consent and comply with procurement processes. Timescales associated with the provision of the grant funding were identified as a problem by several of the projects. Hackney Council commented, “the timescales to meet the project agreement were very restrictive; more realistic timescales to allow for the procurement of the project and agreements on the third-party agreements would have been helpful.”

3.4 Land deals

Authorities should be aware that land deals are needed if non-residential land is included within the project. Skills required in addition to energy-related knowledge include land assembly, land and tenant management, and others specific to stitching infrastructure into a cityscape which has different land ownership patterns and interests, such as knowledge of rights of way, wayleaves and easements.

3.5 Specialist legal services

If a scheme is to take procurement to an advanced stage, it is both timesaving and beneficial to have a legal team that is familiar with DH and energy schemes. Otherwise, it will be necessary to brief the legal team on the complexities of the project retrospectively, which can be difficult. Newcastle City Council benefited from access to experienced solicitors for specialist legal advice and noted, “if this advice and support had not been readily available and already procured, then we would not have delivered the scheme to time”.

3.6 Experienced technical partners

Project developers should take care to select consultant engineers with appropriate expertise and a good track record in the design of DH networks. They will also need to be involved in the close supervision of construction contractors. The use of consultants and contractors with relevant experience will avoid potential problems, for example, the overheating of buildings due to the installation of un-insulated risers and lateral distribution pipes within the building.

4.0 Lesson learnt by developers

With the exception of the retrofit schemes for social housing in Hackney, Newcastle and Birmingham, most projects supported by the LCIF programme involved developers of private housing or commercial buildings. For these, DH was a new experience and many had concerns about the challenge it made to their business processes and methodologies.

4.1 Experience with DH by housebuilders

Large-scale housebuilders are organised on a regional structure. Each enjoys considerable autonomy. Although the overall company may have experience of implementing DH projects in other parts of the country, there was little recognition of this within regional companies, and consequent knowledge-sharing. For a number of years, planning policies within Greater London have prioritised DH and CHP, and required their incorporation on large developments. So DH projects have been implemented in London by developers such as Crest Nicholson and Barratt Homes, but the regional companies seemed unaware of it. Sharing knowledge within companies about vanguard projects could help address the challenges that regional companies faced.

Similar to LAs without previous experience of DH, housebuilding companies had very limited understanding of the energy services market and the value chain in developing decentralised energy projects. Although they had considerably more flexibility in procurement processes than public organisations, they were unwilling to accept risk and preferred to contract the provision of energy services to commercial ESCOs as a package. Although 'brand value' of such commercial companies was initially attractive because they felt it would provide confidence to home-buyers, it was accepted that highly visible companies possessing such 'brand value' had difficulty and less flexibility in delivering smaller projects, such as Wood End, Henley Green and Manor Farm in North Coventry and Yarn Street, in Leeds. On the other hand, larger companies had the financial strength to deliver large projects of over 5,000 homes such as Cranbrook, Exeter. Early appreciation of the operation of the energy services market would have saved time for housebuilders.

4.2 Approaches of housing developers

At the outset of projects championed by LAs, most housing developers were not keen on the inclusion of DH. This ranged from a lack of enthusiasm to absolute hostility. As the developers engaged with the projects, this changed. The Wood End, Henley Green and Manor Farm project in Coventry had three types of developers – flat pack, traditional and mixed. Developers taking the flat pack approach were most prepared to consider DH. In Yarn Street, Leeds, the developer was initially against use of DH, but following discussion with specialist DH contractors, was eager to work with them in addressing the challenges of the new technology. This demonstrates the importance of understanding the needs of each party in the project, and ensuring that experienced and appropriate organisations/individuals are involved at the right time so that all concerns can be allayed effectively; technical problems often require explanation by technically qualified individuals.

4.3 Concerns of housing developers

Developers are understandably concerned about the impact of non-traditional energy technologies on their ability to sell homes – this is fundamental to the issue of managing and mitigating risk. An interesting point was that developers in one area of the country were sceptical of the ability to sell homes by marketing the benefits of 'green living' (even where the LA project team explained the regional appetite for such an approach), whereas developers at Woolston Riverside, Southampton, actively sought

to promote the project as a 'green marketing' tool. In one example a developer felt that gas-fired cooking was vital in order to be able to sell homes, and represented a strong preference of home-buyers in their region. Even where HCA LCIF managers arranged visits to existing schemes where green credentials had proved valuable in the marketing of homes, and the electrical cooking arrangements had not adversely affected it, developers remained convinced of a strong regional dimension to customer perceptions in this respect.

A further concern was matching the build out. This can be mitigated by using centralised boilers to meet developing heat demand, which are later incorporated as back-up and peak-demand boilers once the scale to warrant deployment of CHP has been achieved.

4.4 Need for evidence-based planning and regulation

A detailed energy study conducted for the Cranbrook site demonstrated that a site-wide DH network was the most cost-effective route of achieving CSH Code Level 4 and above. However, the initial phases were only required to meet CSH Code Level 3. Developers planned to meet this requirement through micro-CHP, despite the additional costs this would incur in meeting higher CSH levels on later stages. Possessing this evidence enabled the LA's project delivery team to make the argument for a site-wide solution. Developers on the Greenwich Peninsula scheme also recognised connection to the proposed heat network as a cost-effective way to deliver their requirements under CSH.

A further concern of housing developers was the varying planning requirements in neighbouring areas. They were afraid that the homes built on the LCIF projects would not be able to compete with other homes in the locality with lower sustainability restrictions. As a consequence, Exeter City Council is "designing policies to support the development of low-carbon systems across the city", evidence-based on heat mapping and detailed energy studies.

A planning approach also allows a broader vision that captures opportunities beyond the immediate site. Identification of the adjacent Skypark at Cranbrook enabled this commercial heat load to be incorporated into the project and, crucially, allowed the siting of the energy centre on the commercial land where there was more flexibility due to its lower value.

4.5 Incentives

Housing developers were not keen to go beyond national standards without incentives. There was a perception that developers were focused more clearly on the positive financial aspects of the business case than on penalties such as Section 106. For example, a key element in changing developer attitudes at Cranbrook, Exeter, was the funding for and connection to a by-pass with finance from the Regional Investment Fund, predicated on the development being zero carbon. This suggests that coordinated and focused investment by public authorities, with appropriate conditions, can be a powerful incentive to motivate developers to strive for greater sustainability.

4.6 Policy certainty

The LCIF programme was initiated prior to a General Election, causing uncertainty over the policy direction under an incoming Government. Early in the life of the new Government, the Housing Minister gave a commitment to the continuation of zero-carbon building policy. This was reinforced by a move towards greater sustainability by the continuation of the Feed-in Tariff for renewable electricity, and the commitment to developing a Renewable Heat Incentive. These policies helped to convince developers of the need to achieve higher sustainability targets.

5.0 Lessons for central Government

LAs within the LCIF programme made a number of suggestions to improve support for the development of DH projects in future. Many of these have implications for central Government.

5.1 Financial incentives for district heating

LAs within the programme identified that the scale provided by community-level energy systems can, in the right conditions, enable developments to achieve higher levels of the CSH in a more cost-effective way than individual technologies. This advantage is recognised in the Government's recent consultation on its Microgeneration Strategy. By way of increasing the support for energy systems at this scale, LAs suggested that revenue support mechanisms, such as the Renewable Heat Incentive, are designed to reflect these advantages and incentivise developers in the energy sector to locate new plants close to areas of high heat demand, and work with developers in the property sector to install DH networks.

The complexity of projects, which in some cases had very different multiple priorities, such as affordable homes and energy efficiency, mean that many projects within the LCIF programme needed support from a number of different programmes (LCIF, Kickstart and Community Energy Saving Programme). The different objectives and timescales of the programmes often required considerable effort and time to bring funding together in a way that met with build-out rates across the phases of development. LAs involved in the programme commented that the design of future support mechanisms, such as Allowable Solutions under Zero Carbon Homes and Buildings Policy, should be designed to provide maximum flexibility so that capital support could be best utilised and targeted.

5.2 Staged approach to development

Support for the implementation of DH projects needs to be divided into distinct phases. LAs within the LCIF programme found the development phase onerous and time-consuming – particularly as compared to projects more common to LA activities. Delivery models and procurement routes need to be thoroughly explored to select those most appropriate for local circumstances. Any support from central Government agencies, such as the HCA, the Energy Saving Trust and the Carbon Trust, or the proposed Green Investment Bank, should be separate from capital programmes to allow LAs to complete this necessary work before committing to capital investment.

5.3 Fund for energy studies

LAs found undertaking initial energy studies very helpful in identifying the most appropriate technical solution for new and retro-fit developments. However, it became clear that detailed feasibility studies are also costly. LAs in the LCIF programme felt that some provision should be made, for example some form of mini-fund, to assist in the development and feasibility stages of projects suitable for later capital investment. There was interest among LAs in the EU's ELENA approach used to fund project development by the European Investment Bank.

5.4 Improved guidance

LAs felt that Government could provide better guidance and leadership on the benefits of DH. In particular, guidance on equating technology costs to carbon-saving potential would help to maximise the carbon benefits of developments within their areas. This should be reflected in the guidance provided for different funding and support programmes, and initiatives such as the Feed-in Tariff and Renewable Heat Incentive.

5.5 Rationalising procurement procedures

European procurement regulations for public bodies are complex and time-consuming, and many LAs in the programme found the process difficult to navigate and handle.

The Homes and Communities Agency is seeking to address such problems through the provision of a framework of relevant contractors that have been procured through a full OJEU-compliant process. Companies selected will have been subject to due diligence to ascertain their capability, experience, management structures and financial robustness. The HCA has already made these frameworks available to 150 LAs on housing-related construction and development over the last few years. They can also provide specific advice on the drafting of tender documentation. Further information on how to use the HCA framework panels, or advice on procuring development works or services, can be obtained from deborah.vogwell@hca.gsx.gov.uk

5.6 State Aid

Compliance with State Aid rules presented a challenge to LAs within the LCIF programme. Government could assist with clear guidance; however, LAs also saw benefit in Government testing the State Aid position on centralised programmes like LCIF and providing headline guidance for those involved.

5.7 Recovery of energy investments by Registered Social Landlords

Current rules governing the recovery of the cost of energy-saving investments by Registered Social Landlords (RSLs) prevent their inclusion in tenants' rents and leaseholders' annual service charges. The RSLs must absorb these costs and, in the case of leaseholders, re-charge them in one lump sum. This is a disincentive for RSLs to undertake such projects, or for leaseholders to support them, even though they stand to benefit from them. Allowing RSLs to pass on the cost of energy-saving investments in tenants' rent and leaseholders' annual service charges will allow the development of projects under which residents will benefit from lower energy costs.

The Government should therefore investigate a resolution to these barriers to allow carbon-saving projects to enjoy the support of the communities they seek to serve.

CASE STUDIES

CRANBROOK NEW COMMUNITY, EXETER

The UK's largest zero-carbon development

£3.68m grant funding was provided for DH through a biomass (wood) CHP plant and DH network for the first phase. When fully operational, the energy centre will be capable of generating 5.5MWe of renewable electricity and 17MWth of renewable heat, providing to both Cranbrook and the nearby Skypark employment site, with the possibility of also supplying to the new school. Approximate CO₂ reduction of 15,000t per annum.

LA: East Devon District Council

Technology: Pyrolysis producing syngas to be burnt in engines.

Energy company partner: E.ON

Housing supply: First phase has 1,000 dwellings, 300 of them affordable. CHP will provide heating and power to these dwellings with provision for future expansion to eventually provide heating to up to 5,000 homes, plus the adjacent Skypark and the new school.

Cranbrook New Community is the largest zero-carbon housing scheme in the UK, and the first large-scale new development being built with site-wide DH and biomass CHP. Initial development is 2,900 houses, with 30% of them affordable, and is led by the private sector. Future expansion is planned; possibly more than 5,000 homes.

Site-wide district heating

Each building in Cranbrook and the adjacent Skypark employment site is to receive heat for hot-water and space heating from a network of underground DH pipes. The heat is supplied from an energy centre which, when fully operational, will be capable of generating 5.5 MWe of renewable electricity and 17MWth of renewable heat using wood. The pyrolysis technology heats the biomass in the absence of oxygen to produce a hydrogen-rich syngas which is then burnt in engines. Heat from the pyrolysis process and the engine cooling jackets provides the hot water for DH, and the engines drive generators to produce electricity.

Until there is sufficient scale to efficiently use heat from the biomass CHP unit, heat for the DH system in the interim will be provided by smaller, centralised gas boilers/CHP engines. These units will be retained to provide back-up during biomass CHP maintenance and for top-up heat during periods of peak demand. The scheme is anticipated to deliver a carbon dioxide reduction of approximately 15,000 tonnes of CO₂e per annum.

Cranbrook is part of a programme of strategic developments in the Exeter and East Devon Growth Point that provide strategic housing growth close to skilled employment opportunities in high-quality business parks. In the period to 2026, ambitious but achievable employment growth is envisaged in the Growth Point, with one job created per house built. Translated, this means around 18,000 jobs across the city. Cranbrook itself will provide 1,800 jobs in its town centre, in addition to 5ha of employment land, all secured via the Section 106 agreement for the first 2,900 homes. A new railway station will be created in Cranbrook, with a regular service to Exeter city centre, alongside a frequent, dedicated bus route, offering high-quality passenger transport links to reduce car dependency.

Lessons learnt

— **Close partnership working:** Delivering low-carbon development at Cranbrook has required close partnership working over a number of years. The importance of partnership working was formally recognised in 2007 when East Devon District Council and the South West Regional Development Agency (SWRDA) set up the Exeter and East Devon New Growth Point Team. The Growth Point Partnership is governed by a steering board, which includes representatives from East Devon and SWRDA, Devon County Council, Exeter City Council, the developers and other key stakeholders. This partnership process, combined with the focus, drive and resource provided by the Growth Point Team has been essential to delivering zero carbon at Cranbrook. Access to partners with trusted independent technical knowledge has been critical. Cranbrook has been supported by input from the University of Exeter, the Devon Sustainable Building Initiative (DSBI) and Regen SW, part of which was to oversee an area-specific energy strategy.

— **Solid evidence base:** The energy strategy developed solid technical and financial evidence which made the case for low-carbon development. Key findings of the energy strategy were:

- In larger sites like Cranbrook, site-wide energy solutions were cheaper for developers when CO₂ reductions exceeding 44% of regulated emissions (from a 2006 Part L base) were required. Early investment in DH would benefit subsequent phases.
- The total capital cost of site-wide DH and CHP at Cranbrook was estimated at £24m, which reduced after avoided costs to £15m.
- Although a site-wide DH scheme was the most cost-effective solution at the 44% CO₂ reduction level required in 2013, it was not economically viable in 2010 without additional financial support from the LCIF.

— **Setting requirements in stages:** The results of the strategy were communicated widely and led to the conclusion that initial targets (CSH Code Level 3 and 16% of energy from renewable sources) were out-dated. In large-scale developments that take years to build out (or even start), what are seen as tough standards at the planning stages can rapidly become out-dated, so stakeholders should consider setting requirements in stages, either by year or by unit number. Evidence in the energy strategy was taken to potential energy partners at an early stage, in the belief that commercial reality is only demonstrated by commercial interaction. Cranbrook shows that moving from 'consultants' study' to 'commercial reality' at the right time can save time and money.

— **Improving the economics of the Cranbrook scheme:**

Bringing together the developers of adjacent sites in the Growth Point, the board created the opportunity to improve the economics of the Cranbrook energy scheme through the involvement of the nearby Skypark commercial development. Skypark lies some 800m from the western edge of Cranbrook and is owned by Growth Point partner, Devon County Council, which set high sustainability standards for the site developer (St Modwen). St Modwen had previous experience of CHP and recognised that a joint



Aerial perspective of proposed Cranbrook New Community

© Exeter and East Devon Growth Point

Cranbrook/Skypark scheme could meet its sustainability needs, give a larger and more even heat load, and provide appropriate land for the energy centre. The Cranbrook consortium also saw the benefits of the energy centre being connected but not on residential land.

- **Commercialisation:** The consortium's early selection of a preferred energy provider (E.ON) enabled a single solution to be worked on and a private sector ESCO model to be developed, although writing long-term heat provision contracts has taken longer to develop. DH, combined with the 5.5 MWe biomass CHP solution at Skypark, provided a scheme with sufficient scale to be viable for all parties. Difficulty was experienced in matching planning with the commercial requirements of the ESCO. Experience with the LCIF scheme has encouraged the Growth Point Team to consider what more can be done. Project director Fliss Morey explains, "...with the benefit of the knowledge, experience and lessons learnt from this project, we are designing local policies to support the development of low-carbon energy systems across the city. We are also

looking more widely at new development and existing heat demands through heat mapping and more detailed studies. Because we know how important it is to benefit from economies of scale and heat demand from mixed uses, we are looking to develop local DH networks linking residential and commercial heat loads. We want to ensure that opportunities for low-carbon development are not missed and, in the long term, see the potential for linking individual networks to create more extensive coverage. Most importantly, partnership working will remain critical as Exeter delivers its transition to a low-carbon city."

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New development at Greenwich to be connected to heat network spine

GREENWICH PENINSULA, LONDON

£3m grant funding was provided to install a DH network that will make provision to connect 10,000 homes and retail and office space to a London-wide heat network by providing two heat spines and supporting the construction of an energy centre that will include CHP. Approximate CO₂ reduction of 21,000t per annum.

LA: London Borough of Greenwich

Technology: DH with gas-fired CHP.

Energy company partner: Not yet identified

Housing supply: 10,000 dwellings estimated for connection, with 38% of them affordable.

LCIF funding provided £3m to develop the spine heat network for the Greenwich Peninsula. The Greenwich Peninsula, with its proposals for more than 10,000 new homes, is part of a larger, mixed-use scheme including commercial, retail, educational and leisure uses. The full combination of works includes two significant CHP pipework 'spines' which capture all significant development areas on the Peninsula; provision of connection points (and significant capacity) to the proposed London-wide Heat Network; as well as the energy centre.

The scheme has the ideal profile to 'capture' carbon reduction on a very large scale, and for the creation of real employment opportunities during the construction, operation, and maintenance phases of the works. The scheme will facilitate the provision of low-carbon energy to as many homes and other properties as possible. It will generate immediate employment in the delivery of low-carbon infrastructure, as well as enable the connection of Greenwich Peninsula customers to the London Thames Gateway Heat Network, when available. This is a hot-water transmission network that will connect diverse sources of affordable low-/zero-carbon heat to existing and new developments, helping to create sustainable communities.

The first source of heat will be the surplus from Barking Power Station, normally rejected in the production of electricity.

However, a number of new, advanced conversions from waste technologies are planned, which will also be able to connect. Heat from the power station will be captured and the hot water distributed via pipes to properties for use as domestic hot water and central heating, replacing conventional boilers.

Ultimately, up to 120,000 homes and properties could have their heat requirements met by the 23km network, saving almost 100,000 tonnes of CO₂ output each year.

Lessons learnt

— **Agreeing strategic objectives:** The project team found that agreed strategic objectives between partners are essential at an early stage. Clarity over roles, responsibilities, ownership, risk and liability need to be resolved to create certainty and, hence, confidence, in progressing a joint procurement like Greenwich Peninsula.

— **Commercial:** The project benefited from strong political support and public sector engagement. However, securing commercial-sector investment is challenging given the low level of public sector contribution and lack of guaranteed heat loads. Although Greenwich Council are willing to consider an equity stake, there has been difficulty in securing a tripartite agreement. CSH is significant as developers recognise connection to the heat network as the cheapest way to achieve the required level.

— **Governance:** The project team considered the management of the project as a balancing act between public sector and private sector interests.

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- Mark Baigent, London Borough of Greenwich Project Manager, mark.baigent@greenwich.gov.uk

CRANSTON ESTATE, HACKNEY, LONDON

£0.5m grant funding to install pipe network for the retrofitting of a CHP plant, providing electricity and heat to three high-density housing estates. The funding will also help to provide risers in the high-rise blocks, and interface units within the homes. Approximate CO₂ reduction of 1,500t per annum.

LA: London Borough of Hackney

Technology: DH with gas-fired CHP.

Energy company partner: Not yet identified

Housing supply: 550 dwellings, 100% of the dwellings affordable – retrofit.

This project is a community-driven initiative where residents have positively embraced DH with CHP. Residents already have an established methodology for community engagement and education, which has led to such strong community support. This is seen as something that can be replicated in other locations.

Lessons learnt

— **Commercial:** “One of the main issues was that CHP is a very specialist area and the framework contractor does not have the in-house expertise to carry out works of this nature. It was necessary to appoint an external specialist contractor who was very helpful in building relationships within the market.”



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Installation of pipework at Cranston Estate

— **Process:** “Planning should be a key consideration, and assessed at the earliest stage possible.”

— **Technical:** Construction of a ring-main to replace older systems has increased reliability and ensured greater consumer control and year-round operation. “The project brief must be written by someone with extensive knowledge of CHP who understands the end goal, ie ensuring that the first phases do not restrict the entire project outcome.”

— **Governance:** “Project team recognised an advantage in having London Development Agency and the HCA’s involvement for the unlocking of the wider development scheme.”

— **Prioritising carbon reduction targets:** Hackney Homes is “redrafting its Asset Management Strategy to reflect the council’s increasing prioritisation of achieving carbon reduction targets. We have commissioned a report to determine the best way of achieving funding for meeting these targets across all 30,000 dwellings we manage for the council. Energy management will be an integral part of such a strategy.”

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Preparing for excavation at Cranston Estate

MANTON AND REYNOLDS TOWERS, BIRMINGHAM

£0.78m grant funding to connect two 13-storey tower blocks to a new biomass energy system adjacent to Manton and Reynolds Houses, which will supply heat and hot water to the dwellings in the Towers. There is also potential for the DH system to expand into the new housing development, the community centre and swimming baths at a later date. Approximate CO₂ reduction of 240t per annum.

LA: Birmingham City Council

Technology: The energy house will comprise a boiler room with a 300kw wood boiler and a 3x100W stand-by gas condensing boiler, a 6,000-litre thermal store and a fuel store.

Energy company partner: Not yet identified

Housing supply: The first phase of the scheme will provide energy to the existing 98 homes in Manton and Reynolds Houses, 33% of them affordable, and provide energy to up to 300 new homes in Northeast Newtown, once they have been developed.

One of the key aspirations for Birmingham City Council in the Northeast Newtown area is to create a Community Energy Programme to improve the energy efficiency of existing homes and enable new-build homes to achieve Code for Sustainable Homes Code Level 5/6 now, and level 6 by 2016. The programme could also provide opportunities for income to be generated that could be re-invested into the regeneration of the local area.

The masterplan for Northeast Newtown includes the development of three new schools: Holte, Mayfield and Lozells, currently underway; a new world class youth facility: 'My Place', the development of approximately 300 new homes and the retention and improvement of Manton and Reynolds high-rise flats.

The initial proposal for the Community Energy Scheme was to extend the supply from the new Holte, Mayfield and Lozells schools' CHP energy centre to all existing and planned buildings in the Northeast Newtown Masterplan Area. The first phase of the scheme was to connect Manton and Reynolds Houses, providing wet heat and hot water to 98 flats. The My Place facility would be connected in the second phase, and the new housing development would be connected to the future phases.

Connecting Manton and Reynolds Houses to the Community Energy Scheme would facilitate a more dynamic improvement programme for the blocks that would support the wider masterplan for the area.

The construction of the school was being delivered through the Birmingham Local Education Partnership (LEP) – a joint venture between Birmingham City Council, its private sector partner, and Catalyst Lend Lease and Partnership for Schools (PFS), with investment via the BSF programme. The ambition of the LEP is to deliver the Transformational Agenda to improve the life experience of all young people and improve attainment. This would be achieved by either delivering an extensive rebuild and/or refurbishment programme that promotes the school's role in the community, as well as providing facilities that the community can use.

The initial project required a variation to the council's construction and operational management Private Finance Initiative (PFI) contracts for the new school with Catalyst Lend Lease. Lend Lease would construct the infrastructure from the school's energy centre to Manton and Reynolds Houses, and the council would provide the internal connects to the 98 flats as part of the overall improvement programme to the blocks.

Catalyst Lend Lease would act as an energy supplier and be responsible for energy supply to the blocks for over 25 years.

The original capital cost of the scheme was £1.6m, to be funded by £624,000 from council budgets, £780,000 grant from the HCA's LCIF, and £219,000 from Lend Lease, to be repaid over 25 years.

The complexity of procuring the scheme through varying an existing PFI contract resulted in a reduction in the scope of the scheme and increased cost that made the project unaffordable and this approach was aborted. There were also time constraints that meant Lend Lease could not be reconstituted in order to allow it to trade energy to non-related interests eg housing (see Contractual complexities section below).

Today, the scheme aims to establish a new biomass-fired energy centre to power the Community Energy Scheme, which will, in the first instance, provide energy to the existing 98 homes in Manton and Reynolds Houses and provide energy to up to 300 new homes in Northeast Newtown once they have been developed. Unlike the original proposal, this scheme will be wholly owned and operated by the council.

Key issues

Programme management

As a result of the difficulties in coordinating the school's construction programme and the timing of the improvement programme for the blocks and/or new housing, plus the need for the council to avoid high financial penalties for delays in the construction programme under the PFI contract for the school, the following issues arose:

– **The need to retrofit:** The energy centre in the school was constructed to the original design specification to service the school's energy needs only, and then retrofitted to enable supply to be extended to the blocks – rather than the energy centre being constructed from the outset to supply the blocks.

– **Potential delay:** The mains from the energy centre could not be connected directly to the block until the scaffolding for the improvement works had been struck, which would have presented a 12-month delay to the programme. To overcome this issue, the construction of an Exchange Unit near to the blocks was added to the project, which would enable Lend Lease to connect the mains from the energy centre to the Exchange Unit, in order to meet its construction timescale. The council would then construct the mains from the Exchange Unit to the block at a time that suited its programme of works.

Contractual complexities and limitations

During the contract variations negotiations, the council's Legal Team advised that the scale of the proposal would have to reduce to supply the Manton and Reynolds and My Place buildings only, to prevent the council from being opened up to legal challenge on the issue of competitive procurement.

The reason for this was that the school's PFI contract did not cover activities to benefit the housing needs of the community, and market testing could prove that there were other suitable, qualified and experienced organisations in the market that could provide the service that Catalyst Lend Lease were providing, in terms of constructing and operating community heating schemes.

Connecting the proposed new development of 300 homes to a community energy scheme in the future would need to be undertaken through the council's existing contracts or, if such a contract does not exist, then a competitive tender process

would need to be undertaken. Therefore, the council could not make any guarantees within the variation of contract to enable supply to be extended to the new housing development. Catalyst Lend Lease undertook an internal review of the scheme as it became clear that Birmingham City Council could not meet its future business expectations. The outcome of the review resulted in an increase in the capital costs of the project that the council could not afford, and which would not provide a value-for-money project.

Lessons learnt

— **Process:** “In the early development/conception of similar projects, a thorough understanding of the requirements needed to vary existing agreements/contracts for the operation of an established energy centre in order to extend energy provision needs to be undertaken, in conjunction with a thorough assessment of the legal constraints/implications for all parties.

“The project and funding structure should be divided into the distinct stages of project development to create appropriate gateways where the delivery and procurement routes can be explored thoroughly and agreed, as well as allowing scheme procurement, design, delivery and control processes to be in place for approval before proceeding to the next stages.”

— **Technical:** “The project team recognised that there was a difference of opinion on the diversity factor to be used when calculating maximum heat load. The Danish/German method used by the Catalyst Lend Lease and consultants that carried out the feasibility study seemed very low, which caused concern, especially as one of the blocks was for elderly people who are more likely to require heat and hot water throughout the day. A revised British standard is awaited and may resolve this.

“There is also a potential issue over the encouragement to use biomass as a fuel, with concerns over emissions from the flue. The use of a suitable height flue for the new boiler house will prove challenging in this context.”

— **Governance:** The project would have benefited from a jointly-appointed project manager with a detailed understanding of the project plans and dependencies of both the school construction and block improvement programmes, and to be responsible for managing the overall coordination of both programmes of work.

“The project team identified having learnt to include funders in the appraisal of delivery options, so that they have a greater awareness of potential complexity and risk associated with the chosen route before allocating funds. Furthermore, they recommended informing their setting of grant conditions.”

Faced with the possibility of project failure, the council remained committed and determined to deliver the community energy scheme – quickly carrying out several studies and scheme appraisals in partnership and consultation with various internal and external departments, and identifying an alternative approach that would still fulfil the standards and expected outcomes of the LCIF scheme.

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Top: Manton and Reynolds Towers prior to refurbishment

Middle: Proposed schematic

Bottom: Post refurbishment (artist's impression)

MILTON KEYNES

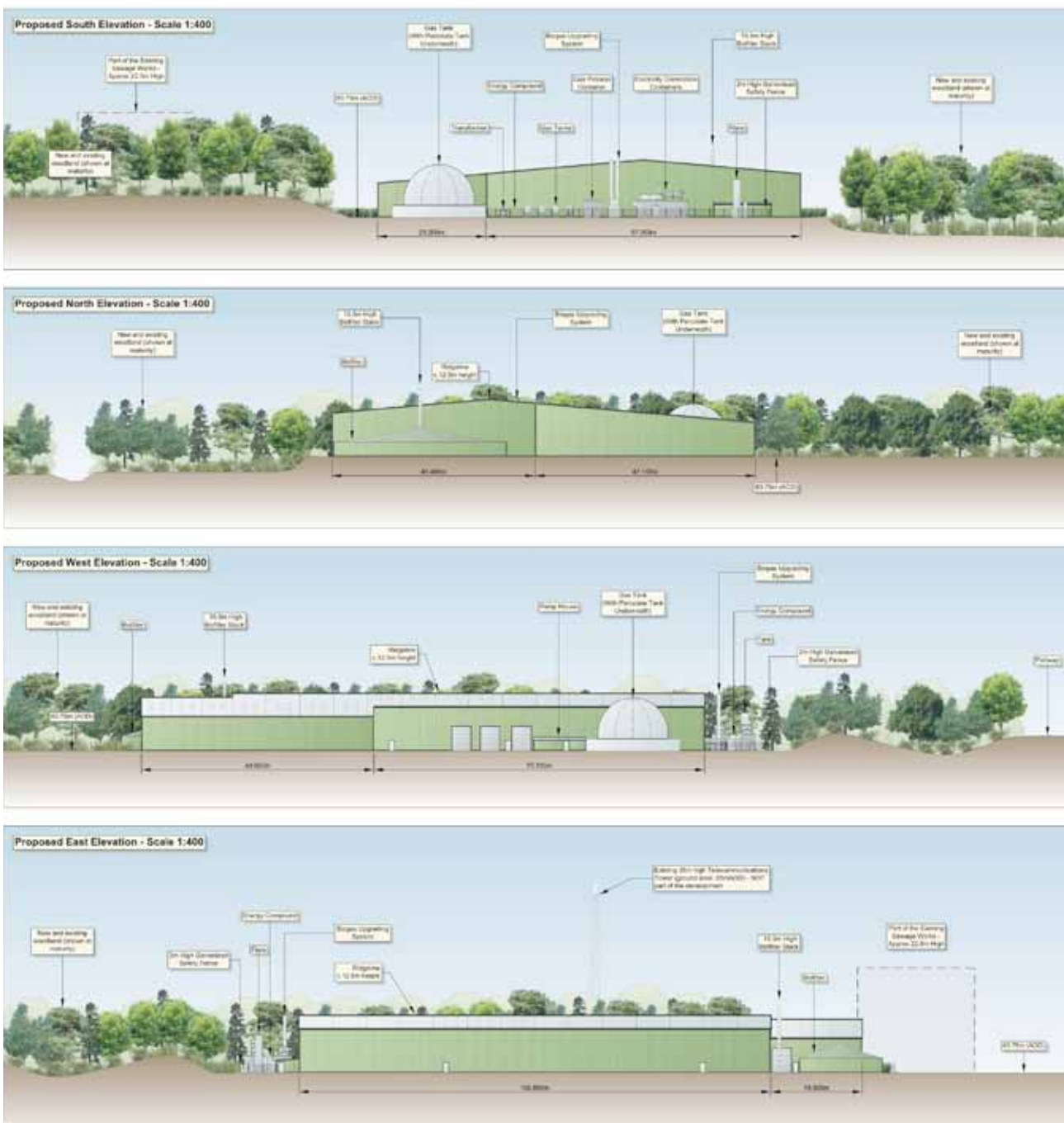
£1.5m grant funding supplied to provide a new bio-methane injection plant situated within the city's planned anaerobic digestion plant, which will power households with green energy by injecting bio-methane into the regional gas network. This will be netted off at the plant room containing a CHP unit serving buildings through a DH network. Approximate CO₂ reduction of 3,490t per annum.

LA: Milton Keynes Council

Technology: Biogas from anaerobic digestion of organic waste.

Energy company partner: Renewable Power Systems Consortium (RPSC)

Housing supply: The number of dwellings is relevant to the virtual connection. At present there are 441 dwellings in the C4.1 site and a further 484 in the CBXII site, all of which are served by the Central Milton Keynes CHP plant. There are a potential further 650 units which are due to be connected to the CMK CHP, in the next phase of residential development. All residential developments are 30% affordable, in a mixture of tenures.



Elevation of proposed anaerobic digestion plant

LCIF funding will enable the Milton Keynes community to enjoy the benefits of an affordable, low-carbon lifestyle consistent with the EU's Concerto programme. The scheme comprises a new plant for the production of bio-methane (at Milton Keynes Council's planned Anaerobic Digestion (AD) plant, 5km from the city centre) and its injection into the regional gas network. The scheme will comprise connecting these renewable fuels to an existing Good Quality CHP/private-wire system in Central Milton Keynes, which serves existing, high-density, mixed-used developments, with the possibility of further extension. The combined technologies will displace approximately 70% of their CO₂ emissions in the area, the gas injection contributing to reductions of around 3,490 tonnes per annum. This will require innovative arrangements to guarantee supply and distribute the renewable gas.

The scheme will significantly decarbonise the current CHP system. This investment will enable the scheme to expand to serve 500 more residential units. The council is committed to developing an AD plant for energy production from organic refuse to be operational from December 2011. To this end, large-scale collection of domestic organic waste in MK began in April 2009, with treatment at an existing conventional AD plant outside the borough. This will ensure a robust collection and supply chain by the time the local treatment plant is operational.

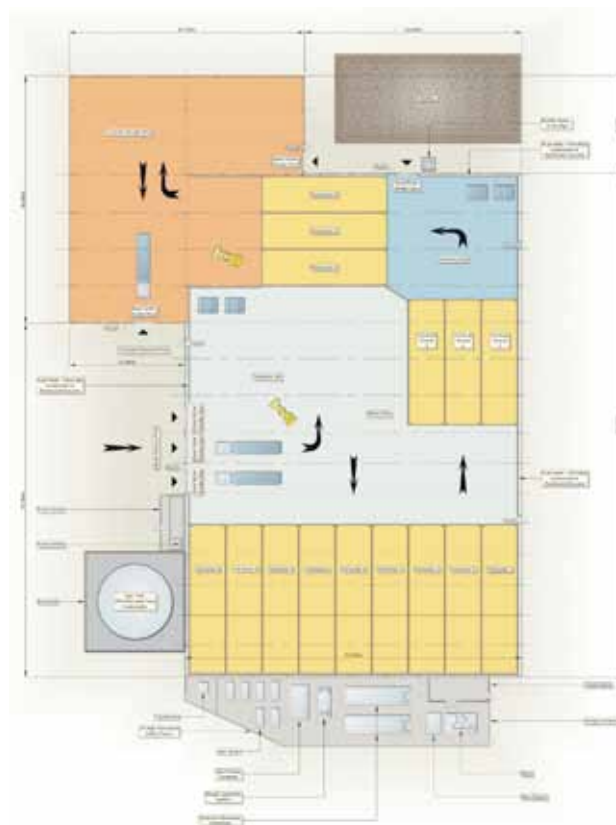
Lessons learnt

— **Commercial:** Because the AD plant operator was to be selected through a restrictive tender process, the initial feasibility and fact-finding about the biogas upgrade and injection to grid was done by the LA. The initial discussion with the network provider, Scotia Gas Networks, was not encouraging since they were very risk-averse to the quality of the gas that goes into the network. Now the service provider has been awarded the contract, more enthusiastic discussions are under way with Scotia Gas, as well as Ofgem (as regulatory body), to work out the appropriate connection protocol. The contractor has applied for planning permission to build the plant.

— **Process:** Milton Keynes Council's project team feel it has been a difficult scheme to carry out, as there is still no UK definition of 'AD-derived gas'. However, the council is a member of European groups which include energy and waste networks, which provided direct access to knowledge in other countries deploying this sort of scheme. There was, and is, so much to learn from regulatory adjustments to ensure delivery.

The most onerous issue was calculating the project's income, as the scheme is so new in respect of the Renewable Heat Incentive (RHI), which has not been agreed to yet, and Renewable Obligation Certificate (ROC), as well as the warranty on equipment for gas.

— **Technical:** The connection of the gas protocol – which is on-going – has been difficult. The treatment of municipal waste using anaerobic digestion and upgrading the resultant biogas with the aim of injection into the National Grid is new to the UK. Although it has been done successfully in other parts of Europe, the standards appear to be much more stringent in the UK.



Proposed layout of AD plant

© Milton Keynes Council

— **Governance:** The project is being managed under the Waste Services Project with a project board and project team. A project plan is maintained, and approval of the Board is obtained at the end of each stage before proceeding to the next. Highlight reports are produced monthly, capturing risk management, issues, decisions to be made and progress updates. It was beneficial that energy and waste departments in the council worked well to share ideas and processes.

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Steve Carr (HCA) viewing heat main at Riverside Dene

RIVERSIDE DENE, NEWCASTLE

£1.7m grant funding to connect five-to-ten council-owned tower blocks and a shopping centre to a biomass DH network, supporting households with high levels of fuel poverty. The biomass DH system works by burning wooden pellets, thus reducing the area's carbon footprint substantially. This project aims to deliver significant carbon reductions of between 40% and 80% through replacing expensive electric storage heaters with DH providing an approximate CO₂ reduction of 358t per annum.

LA: Newcastle City Council

Technology: Wood pellet-fuelled biomass boiler, heat only.

Energy company partner: Vital Energi

Housing supply: 847 dwellings, 50% of them affordable.

The iconic estate, formerly known as Cruddas Park, which was featured in the BBC's *The Likely Lads* and *Our Friends in the North*, is currently enjoying its biggest revamp since the tower blocks were built in the 1960s. With Newcastle City Council (NCC) and its partners, the HCA's investment will help to bring a greener, warmer future for residents.

The Newcastle Riverside Dene scheme comprises the regeneration and retrofit of five-to-ten council-owned tower blocks and a shopping centre. Five blocks have been completed in this phase, with the remainder due to be completed when the housing market recovers. The scheme received £1.7m from LCIF funding to develop a biomass DH network to deliver hot water and heating to the residents of the newly refurbished tower blocks. This was matched by prudential borrowing, covering both public and private blocks. By replacing

the expensive electric storage heaters and providing heat via the DH network, the scheme supports households which experience high levels of fuel poverty. In addition, the blocks have had improved thermal efficiency measures put in place, such as improved insulation and double-glazing throughout, to make them warmer and more efficient.

The system is now operational and has the capacity to supply heat to other schemes in the area now that the infrastructure is in place. The tower blocks are managed by Your Homes Newcastle (YHN).

Lessons learnt

— **Commercial:** NCC "entered into a contract with Vital Energi Utilities Limited (VEUL) to procure and install the infrastructure of the heating system, and for operation, maintenance and life-cycling for the next 10 years. In addition to this, they are contracted to supply biomass fuel for five years, with a guaranteed price for two. The contract unit charge per kWh is to be reviewed on an annual basis (December), based on consumption of the previous year and forecasting for the next.

"NCC are obliged to pass on costs of utilities without profit and VEUL are obliged to provide monthly reports showing the consumption and production of the system. We have a very good relationship with VEUL. They have provided a wealth of expertise and knowledge to the project and have helped shape the actual delivery in terms of making suggestions to improve the initial design. We have a very open and trusting relationship with them which has built up over the life of the project. Clear communication has been key and is something that both parties have worked hard to establish and maintain. This has been to the benefit of the project and the broader programme as a whole."



© Newcastle City Council

Biomass boiler

— **Process:** The project had tight timetables as dates had been fixed for tenants to return to certain blocks. “The most onerous/time-consuming regulations that we had to address related to the procurement and town planning processes. In terms of the procurement process, we advertised by way of OJEU notice. To ensure the scheme could be delivered to time, we used the accelerated negotiated procedure to enable us to shorten the pre-qualification and invitation-to-tender stages of the process. At the same time, we ensured value for money and the needs of the project were still met.” The European Commission issued guidance in December 2008, advising that this type of procedure was justifiable in the current economic climate, to support the rapid execution of major public sector investment projects.

“As this was not the ‘normal’ procurement route for Newcastle City Council legal team, it caused minor delays at times as the rules were checked to ensure we stayed within the guidelines whilst procuring the contractor using this procedure. The council set up a special meeting of its Procurement Committee (a sub-committee of the Executive) to approve the contractor as the committee cycle would have delayed delivery. Due to lead-in times, VEUL needed to order equipment to ensure they could deliver on time. As this needed to happen in advance of a formal committee approval, the problem was resolved through issuing a letter of intent (via officer-delegated powers) to enable the equipment to be ordered accordingly.”

Established dispersion modelling for air quality suggested a requirement of 15m clearance from buildings. However, modelling undertaken by VEUL, in conjunction with exact specification of boilers, resulted in only 10m clearance being necessary. “The other onerous/time-consuming requirement related to satisfying concerns around the air quality as part of the planning process. Air quality requirements dictated the height of the flues. We had to model the proposed emissions from the flues in a range of weather conditions to ensure that the air quality was maintained for all tenants in Cruddas Park

House. It took two months to gain agreement on the height of the flues, which clearly delayed the planning approval. As Gentoo (architects) had submitted the planning application prior to the procurement process, it still fell within the timeframes for the project delivery, although Newcastle City Council carried the risk of the planning application, and not the contractor.”

— **Technical:** Technical expertise would not have been available within the council; however they had access to Dickinson Dees Solicitors for specialist legal advice. Thus, legal advice was regarded as crucial – highlighting the need for procurement of specialist legal services. “Dickinson Dees provided us with the name of an expert in biomass DH schemes, as they had been working on behalf of another authority and had worked with him. We also brought in expertise through the housing regeneration scheme; the Mechanical and Engineering designers had an element of expertise in this field and assisted where necessary, and also an engineer who Dickinson Dees had previously worked with. If this advice and support had not been readily available and already procured, then we would not have delivered the scheme to time.”

— **Governance:** This project was a fundamental part of a larger regeneration scheme for Riverside Dene, which is one of the strategic priorities for Newcastle City Council. The project partners include YHN, Bridging Newcastle Gateshead (BNG)(Housing Market Renewal), Gentoo (architects), Wates (construction), Barhale (externals), VEUL (DH) and Hall & Partners (contract management). The overall project is funded by a combination of monies from Decent (Modern) Homes from YHN, Single Housing Investment Pot, New Deal for Communities, BNG, the HCA and the NCC.

Governance structure

Project Board

Remit: To maintain the strategic direction for the overall project, monitoring in terms of contract performance, budget, funding and meeting the overall objectives. This is the decision-making group and is accountable for the overall project delivery. All other groups, below, report on a bi-monthly basis to this board.

Membership: includes lead officers from NCC, YHN and BNG who have the authority to make decisions on behalf of their organisations). It is chaired by NCC (Regeneration).

Review Group

Remit: The main function of this group is to review blocks six to 10, the neighbourhood centre and retail facilities in the light of current market conditions. The group will conduct a full appraisal on the identified options and present its findings, initially to the Project Board for approval, before presenting them to the YHN Board and Council Executive in September. This will be a time-limited group for the review period only.

Membership: Initially composed of internal NCC officers, but bringing in expertise from other agencies, as and when required. It is chaired by NCC (Regeneration).

Frequency: Fortnightly.

Assets and Finance Group

Remit: The main function of this group is the day-to-day management of the project from NCC and YHN. The group is chaired by YHN and makes minor decisions around all elements of process and delivery, ie proceeding with contract instructions and monitoring delivery of the contract to ensure it is to time and budget.

Membership: Includes NCC Finance and Project Management (ABR), YHN Finance and Clerk of Works, along with Hall & Partners contract management.

Frequency: Monthly.

Communications Group

Remit: Responsible for the planning and delivery of all communications for the project.

Membership: Chaired by NCC (Regeneration). The membership of this group consists of NCC Communications, NCC Project Management, YHN Communications, YHN tenant liaison, and other officers as deemed necessary.

Frequency: Meets monthly at minimum but, in certain circumstances, fortnightly, as the project demands.

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Pat Ritchie, Chief Executive, HCA with a local resident, displaying wood pellet fuel

THE HUB AND SOUTHSIDE, NOTTINGHAM

£1.5m grant funding will contribute to the delivery of a DH system extension to serve proposed new residential and commercial developments in the Hub and Southside regeneration area of Nottingham, supporting housing growth. Approximate CO₂ reduction of 6,786t per annum.

LA: Nottingham City Council

Technology: Extension to existing network, fired by energy-from-waste.

Energy company partner: EnviroEnergy

Housing supply: First phase will develop 70 new dwellings, with 3,328 dwellings in total.

Project background

The project area is situated in a prime location for development; it is adjacent to the city centre and the new transport interchange (known as the Hub) and takes the heating system into the Southside Regeneration Zone. The project will accelerate the deployment of renewable low-carbon energy to new areas of the city and is an exemplar of using renewable energy in major development schemes.

Nottingham's DH system is run by EnviroEnergy, a company wholly-owned by Nottingham City Council. EnviroEnergy use high-pressure steam, created by the burning of commercial and domestic waste at a nearby waste facility, to generate electricity at their Nottingham heat station. This is then used to provide hot water from EnviroEnergy's heat station to heat approximately 4,500 homes and 150 commercial buildings in the city.

The masterplan for the Hub shows that Nottingham Railway Station and the surrounding area will be transformed into an exemplar public transport interchange, where trains will connect with many other modes of transport. Plans for the Hub also include a new 950-space car park and improvements to the nearby highway. This initiative is expected to act as a catalyst for further development activity in the surrounding area. The Hub proposals are supported by the railway station's stakeholders, including the City Council, and public sector funding is committed to complete this project.

Around 970 residential properties are proposed for construction in the immediate Hub/Southside area surrounding the proposed extension to the DH system. The developments also include commercial, retail and office space as well as the rail station improvements, which will all benefit from the availability of DH.

The DH system should reduce CO₂ emissions by approximately 6,786 tonnes per annum and will tackle fuel poverty. The introduction of the Merton Rule, requiring developers to source at least 10% of their schemes' energy from on-site renewable energy equipment, acts as an incentive to developers to connect to the DH system in Nottingham City.

Lessons learnt

— **Commercial:** The City Council's Financial Regulations required that a competitive procurement exercise was conducted, which meant that an already tight timescale was particularly challenging. Nevertheless, the process ensured that equality and value-for-money issues were given full consideration, and an appropriate contractor was selected. Although there was a desire to use the Council-owned ESCO, EnviroEnergy, procurement was too complicated to complete within LCIF timescales and an external contractor was selected. A funding agreement has been developed, under which



Pipe arrangements

connection charges to commercial buildings will be collected by the City Council and recycled back to the HCA.

— **Process:** Members of the project team and board suggest to “fully identify resources at bid stage in terms of staffing cost and time needed at each stage of the project, and be realistic... Involve a broader cross-section of internal staff in the bidding process, as their experience and input could help tease out potential pitfalls... Fully engage the appropriate internal officers in terms of the contract specification eg finance, legal.”

— **Technical:** The project team notes that sufficient time should be allowed to negotiate terms of agreements with affected landowners in order to maximise cost benefits. This was challenging within the time required by the HCA on completion date and funding support.

Any technical issues were resolved by multi-disciplinary design, using the expertise of EnviroEnergy, Nottingham City Council and Vital Energi (the contractor selected to implement the extension).

The project board and team felt that the project would have benefited from a longer timescale to complete works. There were several time-consuming processes, which had to be in place before construction works could begin, such as agreeing terms of the Funding Agreement with the HCA, procuring a contractor, and third-party landowner agreements.

— **Governance:** The Council has appropriate project governance in place for delivery of the project in line with best practice. The Council's Executive is ultimately responsible for the delivery and decision-making of the project. The Council used the expertise of internal officers and EnviroEnergy to create both a project board and project team soon after funding was secured, which both meet monthly. The project board has delegated authority to expedite the decision-making to provide efficient and effective delivery of the scheme. The project team is used to discuss more detailed technical issues and practical resolutions, and reports to the project board.

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WOOD END, HENLEY GREEN AND MANOR FARM, NORTH COVENTRY

£1.6m LCIF grant funding was intended to design and install a DH system for 154 houses in the Wood End, Henley Green, Manor Farm and Deedmore area of Coventry (collectively known as WEHM). However, the project was not able to progress to delivery stage. Carbon savings of around 1.2t CO₂ per annum per house had been anticipated, equating to 185t CO₂ per annum for the site. Also, it was hoped this smaller scheme would contribute to the deliverability of other future schemes in the city by providing a test-bed case and building experience to be transferred to future schemes.

LA: Coventry City Council

Technology: Gas-fired CHP proposed.

Housing supply: Intended for 154 dwellings in the first phase, with a total of 3,328.

Lessons learnt

— **Commercial:** The project had planned for the housing developer to procure the ESCO to construct the plant, although the council would hold the asset due to State Aid rules. Furthermore, it was necessary to change commercial ESCO partners because the project was too small for the large ESCO company initially selected. "Key issues that caused problems were the contractual negotiations between the various parties and, as this is a relatively new area, (they) became overly protracted." Due to this, the housing development progressed ahead of the CHP, and so the project became undeliverable.

— **Process:** The key problems for the project were:

- Levels of understanding of the issues, and learning curves that all staff and partners had to go through.
- Understanding of contractual issues in the legal team.
- Understanding of contractual issues in the project team.
- Cost of procuring legal advice.
- The worry and potential implications of the fact that LCIF funding could not be used to fund in-house resources (legal, project management).

Overall, it was difficult to assemble an effective project team.

— **Technical:** The project team suggested that the HCA staff should provide ESCO, CHP and DH training courses, as well as putting together an effective brief for legal consultants to get a thorough understanding of the legal issues surrounding DH/ESCOs etc. They also suggested training in equating the costs of the project to carbon savings potential.

— **Governance:** Coventry City Council acted as client and client-side project manager. Those staff report to a programme board which includes members from the City Council, Resident Social Landlord, New Deals for Communities (NDC) and the HCA that oversees the main development. An operational project team was put in place, comprising representatives of the project board, plus representatives from the developer. The developer was intended to project manage the contractor on-site.

The progress of this project is currently being reviewed.

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- Tim Jones, Coventry City Council Project Manager, at tim.jones@coventry.gov.uk



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Construction site and pipe installation at Mayflower Gantry, Southampton

MAYFLOWER GANTRY, SOUTHAMPTON

£0.65m grant funding provided to connect the regeneration scheme to Southampton's deep geothermal DH network which includes National Affordable Housing Programme funding for 485 new homes, plus a community theatre. Approximate CO₂ reduction of 190t per annum.

LA: Southampton City Council

Technology: Extension to existing network, fired by gas-fired CHP.

Energy company partner: Cofely District Energy

Housing supply: 115 new dwellings, with 75 of them affordable in the first phase; 186 new dwellings in the Mayflower New Plaza; and 184 retrofitted, totalling 485 homes.

The LCIF grant of £0.65m was given to Southampton City Council to connect the Mayflower Gantry regeneration scheme to Southampton's deep geothermal DH network. The scheme accords with the council's Affordable Housing Partnership's target of having 2,000 affordable homes by the year 2012, as well as supporting economic growth by increasing housing construction and the Council's 'Energy Vision'.

Lessons learnt

— **Commercial:** "The processes between the energy service provider and the LA exposed some issues with regard to compatibility between existing agreements with Utilicom (now Cofely District Energy) and forming contracts for new projects: in this case, we wished to pass down a version of the HCA grant agreement onto Utilicom, but this was difficult to do, in the end forcing Southampton City Council to take the risk on a number of issues that normally would be expected to be borne by the contractor. Finding a method that all parties could accept was a difficult process. However, this is a matter specific to Southampton and work is underway to examine how to improve this for the future."

The council has an existing Joint Cooperation Agreement with Utilicom, relating to supporting the city centre district

energy network, which has provision for a profit-share element. During the project development, Utilicom was purchased by a larger company, jointly renamed as Cofely, which had improved credit ratings and greater flexibility on sharing risk.

— **Process:** "Overall, the process was an effective one due to the will from all parties to make a high-quality bid and resolve any issues that might arise. However, there are ways in which things could be improved to streamline the process."

Resolving the issue of State Aid at the LCIF programme level could be such an opportunity. It might be an idea for the HCA to demonstrate that the LCIF programme itself is State Aid compliant (some central Government funding streams have done this eg the LCBP2) so as to avoid repeating work at the local level for each LCIF project.

For the Gantry project, the process between the developer and the LA was very smooth. The development project was very advanced and was already considering methods for CO₂ reduction. Hence, it was a natural progression to work together on extending the district energy network to connect up the development.

— **Governance:** "The existing Geothermal Strategy Board and Geothermal Technical Board meet to address all issues relating to the existing city centre district energy network. The LCIF Gantry project is an item on these Boards' agendas. A project board consisting of Cofely, the relevant Southampton City Council officers and Drew Smith (contractors) has been formed to ensure the project progresses smoothly."

A track record of delivering district energy projects allowed for work to get started very quickly and, many times, working ahead of schedule.

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WOOLSTON RIVERSIDE, SOUTHAMPTON

£2.5m grant funding was given to create two energy centres on-site for this new, mixed-use development that will deliver a site-wide community heating system. This scheme will supply heat to 1,620 homes, a superstore and a hotel, by helping to deliver the comprehensive regeneration of Southampton's Woolston Riverside. Approximate CO₂ reduction of 1,017t per annum.

LA: Southampton City Council

Technology: Gas-fired CHP.

Energy company partner: E.ON

Housing supply: 1,620 dwellings including 405 affordable homes.

The site is located on the eastern bank of the River Itchen, north of its confluence with the River Test in Southampton Water, 2km to the southeast of Southampton City Centre. The site is owned by the South East England Development Agency (SEEDA), working in partnership with Southampton City Council (SCC).

The scheme represents the comprehensive redevelopment of the former Vosper Thorneycroft shipyard, which will provide a mixed-use development comprising:

- 1,620 dwellings (including 405 affordable homes)
- Retail (Class A1 – 5,525 sq m, including a food store)
- Restaurants and cafés (Class A3 – 1,543 sq m)
- Offices (Class B1 – 4,527 sq m)
- Yacht manufacture (Class B2 – 21,237 sq m)
- Business, industrial, storage and distribution uses (Class B1/B2/B8 – 2,617 sq m)
- 100 bedroom hotel (Class C1 – 4,633 sq m)
- 28 live/work units (2,408 sq m)
- Community uses (Class D1 – 2,230 sq m)
- 2 energy centres (1,080 sq m)

The proposals for the scheme also include a number of 'eco' features, such as sedum roof areas, rainwater harvesting, and a graduated shingled 'beach' area designed to propagate wildlife and plants, as well as to link people with the waterfront.

The scheme includes plans for a site-wide community heating scheme that will supply heat to all dwellings on the site and a range of commercial uses, including the food-store, hotel, and Marine Employment Quarter. Two energy centres located to the northeast and southwest will provide heat to the development using a CHP-led Heat Production Strategy. The energy centres will be connected by high-efficiency gas boilers. In later phases, a biomass or biofuel boiler may be used to further reduce the carbon emissions across the development site.

Lessons learnt

– **Commercial:** "HCA involvement in other funding streams aside from LCIF lent more weight to the overall scheme and meant that the developer also engaged with the LCIF programme.

"The project team regarded the setting up of agreements as a complex process, as although SEEDA is the main driver for the scheme, the LCIF funding was awarded through Southampton City Council. Crest Nicholson apply to SEEDA for LCIF funding to be released to them and this is governed by a Crest-SEEDA grant agreement. SEEDA, in turn, apply to SCC for the funding to be released, which is governed by an SCC-SEEDA grant agreement. Finally, SCC have a grant agreement with the HCA.

"The developer, Crest Nicholson, is now using the LCIF programme as a 'green' marketing tool."



© Crest Nicholson

Secretary of State for the Department for Communities and Local Government, the Rt Hon Eric Pickles MP, laying the first brick

– **Process:** The project team recognised that "the formation of contracts with [the] private sector was the hardest part, although this is to be expected for such a complex project. In this regard, it was useful to have the support of the HCA in ensuring that the grant agreement met the needs of the public sector partners. Multiple public and private partners increased the complexity of the project and achieving confidence amongst all parties was difficult. This made complying with State Aid rules challenging in determining which party should carry risk."

– **Governance:** The monitoring plan for the scheme is based on a contract with Crest that sets clear milestones, which was regarded as helpful. The Woolston Riverside Project Board meets monthly and covers the entire scope of the Woolston project. The Woolston Energy sub-Group reports to the Project Board and was set up to manage the LCIF HCA bid and its implementation.

"A minor issue concerned agreeing response times within the grant agreement (eg to respond in 10 days) as, for the Woolston project, there are three partners who act in series rather than parallel. For example, if there is a limit of 10 days to respond to the HCA on a point, in practical terms this period is shortened for each partner due to the chain of communication (HCA-SCC-SEEDA-Crest)."

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YARN STREET, AIRE VALLEY, LEEDS

£1m grant funding to provide a new heat network supplying CHP energy from waste-plant and micro-technologies to 230 new homes that will form part of the urban eco-settlement vision for the area. LCIF funding will provide this community-owned new heat network; 15% of the housing development will be affordable. Approximate CO₂ reduction of 1,500t per annum.

LA: Leeds City Council

Technology: Gas-fired CHP.

Energy company partner: Vital Energi

Housing supply: Total of 280 homes – 168 family homes and 112 flats.

Lessons learnt

— **Commercial:** The processes between the energy service provider and Leeds City Council were regarded as satisfactory, "...but as the process undertaken by the council was facilitating the private sector installing the system, through Miller Homes, there was limited opportunity to grow our capacity for future opportunities. Miller Homes was very insistent that all funding was in place before development proceeded."

— **Process:** The project team recommended setting clear scoping of requirements before the funding mechanism is established, and for this to relate to how LAs are required to act for future developments.

The project team recognised that there is significant pent-up demand for local CHP provision, but that to make a significant sustainability solution, councils need to take a strategic approach, preferably for large-scale provision across a wide area of Aire Valley, Leeds.

— **Technical:** This community-owned scheme with its smaller-than-usual site is proof that CHP can be replicated in smaller sites and can be scalable to take advantage of programmed site developments in the adjacent areas. However, the rapid LCIF time-scales may result in under-optimisation of the location of the energy centre.

— **Governance:** The Council adopted a standard programme and project management methodology which was applied. There was local governance through a project board. Vital Energi are undertaking the project development and the wider governance is directly with Miller Homes, the HCA and the council with the intention to sell-on at a later date. However, the council is carrying the risk under State Aid rules.



Pipe installation

© Homes and Communities Agency/Luke McDonald

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CAMBRIDGE AND CRESCENT TOWERS, BIRMINGHAM

£1.5m grant funding was given to replace the dated heating systems contained within the 16-storey, 120-unit, council-owned Cambridge and Crescent tower blocks located in the city centre, and link them to the existing CHP DH system in the International Convention Centre on Broad Street, which has been updated for the purpose. It will heat homes (100% affordable) that currently have expensive electric heating, extending efficiency and providing affordable heat and power to protect the fuel-poor who are already receiving Decent Homes funding. Approximate CO₂ reduction of 347t per annum, aiming to reduce CO₂ emissions by 60% by 2026.

LA: Birmingham City Council

Technology: DH network (pipework) and DH connection from the existing Broad Street District Energy Scheme. It is a good-quality, gas-fired CHP scheme with high-efficiency gas boilers.

Energy company partner: Birmingham District Energy Company

Housing supply: 248 flats.



© Birmingham City Council

Refurbished Cambridge and Crescent Towers, Birmingham

Lessons learnt:

— **Commercial:** The project was undertaken as part of Birmingham City Council's (BCC) Housing Department's capital programme. Birmingham District Energy Company (BDEC), a subsidiary of Cofely District Energy, operated in partnership with BCC. A project delivery team was established, comprised of Cofely, Wates, Urban Design and BCC's Housing Department. With specialist knowledge within the project delivery team, and established framework agreements, progress was relatively smooth.

— **Process:** Procurement of BDEC under an established framework agreement was led by Urban Design, a department within BCC. Internal heating systems within the flats were installed by Wates. Design and installation was carried out by BDEC. The project recommended, "a detailed site survey before construction commenced to identify the obstacles resulting in the planned overspend". Without HCA funding, a greater risk provision would have needed to have been attached to the original proposal to be financially viable.

— **Technical:** Installation of a new wet heating system to individual dwellings connected via an external heat exchanger building to the existing CHP DH system. Design issues highlighted a considerable difference between 'Danish design method' and British Standards, resulting in a difference of opinion within the design team. A revised British Standard is now under development.

— **Governance:** On-going operation and maintenance of the project will be carried out by BDEC. The infrastructure contained within the blocks, including risers and common areas, will be managed by BCC's Housing Department.

"The scheme will be the first of its kind in Birmingham and the installation of DH to residential properties when joining to existing CHP has provided a different set of delivery issues to stand-alone district heating."

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HANHAM HALL, SOUTH GLOUCESTERSHIRE

£0.8m of LCIF grant funding supplied to extend the planned on-site CHP plant, powered by a woodchip biomass boiler, that will generate zero-carbon electricity and hot water to the development's 186 zero-carbon homes, the refurbished listed building, and the nearby NHS facility and doctors' surgery. The scheme will also take the waste heat for heating use in the neighbouring secondary school. Approximate CO₂ reduction of 1,170t per annum.

The Hanham Hall LCIF scheme is part of a larger regeneration scheme; it is the HCA's first Carbon Challenge project, aiming to demonstrate to the housebuilding industry that it is possible to move towards zero-carbon housing. By 2013, a new community of homes, all meeting Code Level 6 of the Code for Sustainable Homes, will be built, and a derelict, former Grade II listed hospital site will be brought back into use.

LA: Gloucestershire District Council

Technology: Gas pyrolysis CHP.

Housing supply: 186 zero-carbon homes.

Lessons learnt:

— **Technical:** The implementation of zero carbon has changed since the inception of this project and, with some details still to be clarified for 2016, it has been challenging to ensure that this first large-scale, zero-carbon project is still a relevant demonstration project for the building industry.

— **Commercial:** The small scale of this project provided a major commercial challenge. This was exacerbated by initially being residential only. However, connection to the nearby NHS facility and doctors' surgery improved the financial case and the recent introduction of a Feed-in Tariff has changed the economic viability of other renewable technologies which could be relevant to the scheme design.

— **Process:** The energy partner E.ON was not involved with the original bid as it is a later partner with Barratt Developments to work on at least 10 sites. Whilst this partnership has brought new expertise to the development, it has also led to changes to the project, such as altering the capacity of the energy centre, and the implications of that, with planning permission already granted.

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© Barratt Developments Plc



Above: Hanham Hall

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Right: Barratt Homes development at Hanham Hall (artist's impression)

GLOSSARY

allowable solutions: will form part of the zero-carbon buildings requirements under Part L of the building regulations. They are likely to take the form of a financial payment by developers on residual CO₂ emissions after the required building fabric improvements and on-site 'carbon compliance' measures have been undertaken.

Carbon Reduction Commitment: a 'cap-and-trade' mechanism for large energy users, providing a financial incentive to reduce energy use by putting a price on carbon emissions.

Codes for Sustainable Homes (CSH): The Code for Sustainable Homes is a voluntary national standard for the sustainable design and construction of new homes in England. It uses a six star rating system to measure the sustainability of a new home against nine categories of sustainable design, rating the whole home as a complete package. It covers energy and carbon emissions, water, materials, surface water runoff (flooding and flood prevention), waste, pollution, health and well-being, management and ecology, and sets minimum standards for energy and water use at each Code Level.

Combined Heat and Power (CHP): generating heat and power (usually electricity) in a single process, by which less heat is wasted, and heat that would normally be released into the atmosphere, rivers or seas is usefully captured and employed.

Community Energy Saving Programme (CESP): programme for delivering whole house refurbishment of existing dwellings through community-based projects. It is funded by the energy generators and suppliers.

Community Infrastructure Levy (CIL): this is a charge which local authorities in England and Wales place on most types of new development in their area to pay for local and sub-regional infrastructure to support the development of the area.

Decent Homes: The Decent Homes Standard is a minimum standard set by Government for social housing, which requires homes to be in a reasonable state of repair, have reasonably modern facilities and services and provide a reasonable degree of thermal comfort.

district heating (DH): a system for distributing heat generated in a local centralised location for residential and commercial heating requirements.

district heating network infrastructure: the pipework which connects the central energy plant to the buildings using the heat.

ESCO (Energy Services Company): a business providing a broad range of energy and carbon management solutions, including the design and implementation of energy-saving projects, energy conservation, power generation and energy supply.

Growth Point: these are communities selected by Government that are pursuing large-scale, sustainable housing growth through a partnership between local organisations and central Government.

heat map: a map showing locations where heat demand is sufficient to support district heating. Often included as part of an energy map.

Hydraulic Interface Unit (HIU): this is the interface between a district heating network and the heating system within a home. It contains the incoming and outgoing heat mains, control valves and metering system. Pipes run from it to the radiators and, if present, a hot water cylinder.

Registered Social Landlord (RSL): these are government-funded, not-for-profit organisations that provide affordable housing. They include housing associations, trusts and cooperatives.

Section 106 agreement: the Section 106 (S106) of the Town and Country Planning Act, 1990, allows a local authority to enter into an agreement or planning obligation with a landowner associated with the granting of planning permission. They are a way of delivering or addressing matters that are necessary to make a development acceptable in planning terms, such as supporting the provision of services and infrastructure, including highways, recreational facilities, education, health and affordable housing.

State Aid rules: State Aid is a European Commission definition referring to forms of assistance from a public body, or publicly funded body, given to undertakings on a discretionary basis, with the potential to distort competition and affect trade between member states of the European Union.

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Page 10: Figure 2: Heat loads map of Hackney. By permission of Parul Khandelwal, AIEA, Sustainability Officer, Conservation, Urban Design and Sustainability Team, London Borough of Hackney.

