Interreg
North-West Europe
HeatNet NWE
European Regional Development Fund

HeatNet Guide to Financing 4DHC

Researched by	Checked by	Reviewed by	First Draft	Final Draft
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About HeatNet NWE

This document has been developed as part of the HeatNet NWE project, which is part-funded through the Interreg NWE programme and aims to increase the uptake of 4DHC networks across North-West Europe. As part of this project, the partners are developing the HeatNet Model, which will help the public sector to begin implementing 4DHC networks, and the Transition Roadmaps, which will outline the partners' experience in developing six district heating pilots across North-West Europe.

For further information on these reports and on the HeatNet NWE project, please visit www.nweurope.eu/heatnet.

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1. Introduction

This guide is about project finance for district heating and cooling projects.

In energy related schemes, it is normally the case that the project should be able to cover its costs by either saving money or generating revenue from energy sales. This creates revenue streams that can be used to repay any borrowed capital that is used to pay for the project's construction and equipment purchase and installation costs. This ability to repay capital makes the project of interest to external investors.

The guide is targeted at project managers tasked with developing and implementing district heating and cooling projects, which tend to be large and complex. It aims to impart an understanding of what investors need in relation to the financing of energy projects, and provides an overview of the different sources and structuring of investment finance.

What is unique about financing for 4DHC?

1. Broadly speaking DHC systems in general are difficult to finance because of the cost of putting distribution pipes in the ground. Very simply, this cost is difficult to recover because default heating energy prices can be moderated in the market place by factors such as the cost of gas, for which the distribution infrastructure is already paid. This will vary in different locations, and where gas is increasingly being replaced by electric, as the default position. This can affect scheme viability, therefore making investment seem risky.
2. 4GDHC is innovative in relation to its components and their combinations and configurations. Investors will regard systems that are new (and so do not have a long track record against which to assess performance risks) as more risky.
3. As well as technological risks, there are policy risks with DHC in general because public support is often needed to bring projects to reality. Investors will therefore look at the strength of support from central and local governments, subsidy regimes and so on.
4. As risk levels increase, finance becomes more expensive and harder to secure. Therefore, for schemes that are already at the margins of profitability, affordable finance can be hard to find.

2. Access to finance

2.1 Why may finance be needed?

District heating & cooling schemes typically cost €millions to install. Organisations may want finance because:

- They have competing demands for the capital that they have available
- They may want to share the financial risks inherent in a running a DHC scheme with others (investors)
- They may want to bring in expertise (e.g. a private ESCo with DHC design and operating experience).

2.2 Assessing project finance

Projects look very different depending on whether you look at them from a technical or a financial perspective. The purpose of this guide is to inform the project manager regarding how project finance works in a general sense and what factors investors will expect to see in a project before they will finance it. Other guides from HeatNet focus on technical perspectives.

UKs Green Investment Bank (now the Green Investment Group) has provided a short but very useful guide to the information needs of investors in the context of heat networks, a summary of which is duplicated below:

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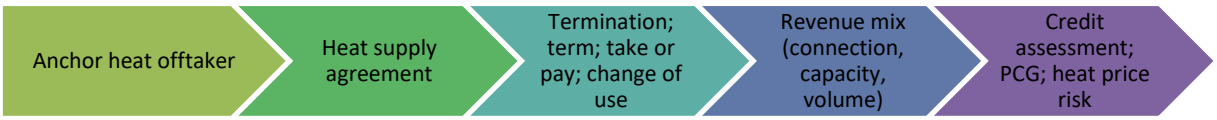
Information requirements for investment

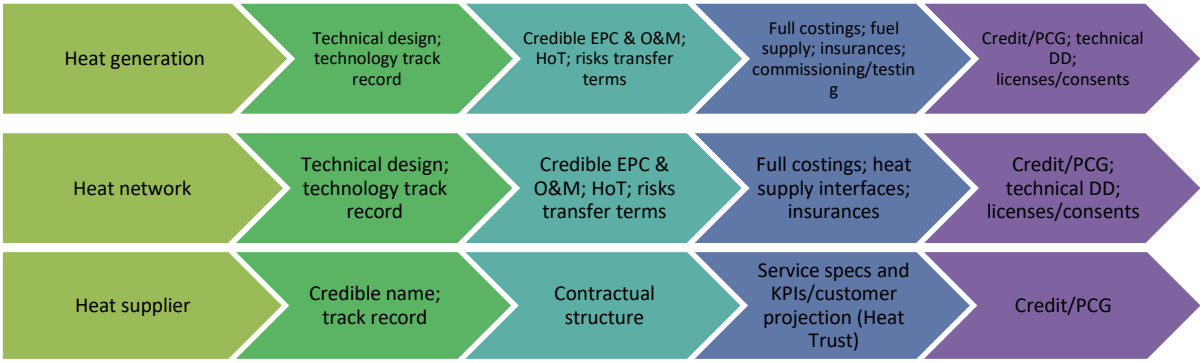
During the early stages of project development it is important for local project teams to consider what is required for commercialisation and investment. The information set out below is required to underpin good project economics, to establish an investable risk:return balance. This is not an exhaustive list, nor will each investor or partner be interested in all of the project aspects. This will depend on the project development stage and the nature of the required investment.



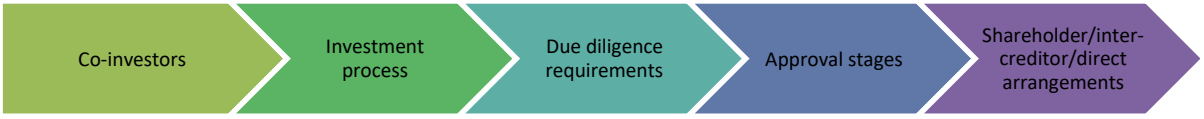
Attractive projects will have secured a material portion of the heat loads from strong credit counterparties (anchor customers early on in the development process). Longer term heat supply agreements with minimum offtake and disincentives for disconnection will reduce overall project demand risk. Price risk transfer mechanisms are also important to match with heat supply costs, such as the mix of connection fees, fixed standing charges and variable charges using appropriate uplift indices. Offtake contracts could be with end users directly or heat could be sold in bulk to an intermediary such as the local authority, housing association or property manager, who take some credit risk through on-billing end users.

Heat mapping and phasing of future connections allows investors to assign a level of probability to heat load evolution and determine project upside; the more advanced the state of negotiations are the more likely that an equity investor can consider income as part of the base case assessment. An equity investor will also determine upside potential and put in place business development capabilities to expand the network. Over time, a larger, diverse customer base will provide a more stable and robust income base

Many schemes include CHP plant to supply heat, realise carbon savings and secure additional revenues. As with other income streams, a project with secure electricity sales contracts will be more attractive, particularly where this contributes a significant portion of the base case project returns. These could include private wire contracts or export to grid contracts.



Attractive schemes will have been developed in line with industry standard design, appropriately licenced and consented, using proven technology, by developers with good delivery track records. Project risk can be reduced through fixed price contracts, transfer of operational risks to subcontractors, warranties/guarantees/insurance from strong credit counterparties. Appropriate operations and maintenance regimes can reduce risk profiles and maintain returns through optimising generation and service base and peak loads. Heat network pipe infrastructure will be technology-agnostic to accommodate multiple heat sources and have flexibility to change sources over their 40 year lifetime. If heat is bought at the boundary of the heat network the security of the heat supply will be critical to assessing operational risk.



Where a scheme requires multiple investors it is important to design an appropriate fundraising plan which looks to secure strong equity counterparties initially followed by debt investors. The scheme capital structure should align incentives of key investors, funders and key customers through use of shareholder, inter-creditor and direct agreements in conjunction with well drafted scheme income and expenditure contracts.

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Similar issues are covered in more depth by the European Financial Institutions Group 'Underwriting toolkit' for the wider energy efficiency investment market.

3. Project development standards & support

One of the consistent themes in energy efficiency and renewable energy finance is the need to develop projects to a sufficient standard to meet investor's information requirements.

Energy projects are judged (from a finance perspective) on their costs versus the energy costs saved (through efficiency measures) and/or value of energy generated - both creating revenue streams from which finance can be repaid. The reliability of these revenue streams is the principal risk for investors. As such they are a key focus and an investment manager will expect well-developed projects to address how these risks are mitigated.

3.1 Project risks

The main risks they are concerned with are:

- Connection risk
- Payment risk
- Performance risk.

A risk management guide is available at:
http://www.eefig.com/images/pdf/EEFIG_Underwriting_Toolkit_June_2017.pdf

Generally, risk mitigation falls into 4 categories:

1. Warranties on equipment. These provide recourse to the maker/supplier/installer (or insurance underwriter) in the event that the equipment fails or fails to perform as promised.

2. Performance insurance. Insurance is beginning to become available for energy efficiency projects, where they are developed to a sufficient standard (such that the insurer is able to assess the risk they are taking on).

3. Performance guarantees. Energy Performance Contracts (EPCs) come in many forms. The principle is that a supplier agrees to install efficiency measures and to provide a guarantee, typically in the form of a minimum % saving or a fixed annual energy charge, thereby taking the performance risk. Companies offering this type of service are generally referred to as ESCos, energy service companies. They can be private, community or municipally owned, or joint ventures. They may be established especially to operate a local energy scheme (generation, distribution, efficiency), or may have a wider market presence. Not all ESCos offer EPCs, which is a specialised product.

4. Payment risk. Who is responsible for making the loan repayments and how creditworthy are they? This can extend beyond the borrower, to tenants for example. Either the borrower must be able to afford to underwrite its own payment risks, or another mechanism be put in place. One such is forfaiting, which is suitable in relation to tenanted properties. In this case a third party buys the receivables (that is, the monthly receipts due from the energy service charges levied by the building owner), so taking the income for themselves. They do this for a discount (for example, paying 90% of the anticipated income) in return for taking the risk that some tenants might default or fall behind with payment. In this way, the risk is isolated from the investor. e.g. http://citynvest.eu/content/sunshine-3

There are benefits to project owners too, in developing projects to this level of detail. For example, understanding the lifetime costs and benefits of efficiency measures can lead to more sustainable and more cost effective purchasing decisions than if only the initial investment cost is considered. In another example, project owners can contribute to mitigation of performance risk by ensuring that staff are trained sufficiently well to be able to operate equipment correctly.

3.2 Standardisation of project development

Review of project plans (due diligence) is a significant cost for investors. It involves assessment of the financial projections, technical specification, and risk management. There are some initiatives, which are being developed to reduce transaction costs by standardisation of project development. This will provide investors with more confidence and should improve the availability of finance for good quality projects. Two such initiatives are Investor Confidence Project Europe and Qualitee project.

3.3 Support for project development

There are some sources of financial support for the project development phase at a European level:

European Local Energy Assistance (ELENA) provides technical assistance funding at a grant rate of 90% towards the development of energy efficiency and renewable energy projects. A minimum portfolio size of €30 million investment value is required, and for every €1 spent on technical assistance, €20 of investment must be delivered within the three year grant period.

European Energy Efficiency Fund (EEEF) has a technical assistance component. ELENA funding is used to supply technical expertise to project owners, and funding to pay necessary legal and similar costs. This is useful for projects, which are not part of a large enough portfolio to meet ELENA eligibility requirements.

There are many sources at national levels, listed in Annex 1.

Project development guides

Project development, to investment standard, is an exacting process requiring a great deal of detailed planning and modelling of energy use and costs and careful allocation of risk and structuring of finance. A number of guides are available to help commission this process.

A comprehensive set of guidance is available from the UK government

- Introductory guidance
- Detailed guidance;

The Green Investment Group provide a useful summary guide to heat network projects from an investor perspective.

Many other guides are available, targeting different audiences and different aspects of district heating and cooling. Some are presented in Annex 2.

As district heating and cooling systems develop towards multiple energy sources and open access (allowing excess heat to be sold into the distribution network), new business models will evolve. From a finance perspective, each investment will have to pass scrutiny as a viable project that can deliver an acceptable risk/reward ratio.

Project development support services:

In some locations, there are support services, offering a range of specialist advice and consultancy support, such as the examples below.

RE:NEW & RE:FIT. These are UK examples of project development units established for social housing and non-domestic energy efficiency projects respectively. Comprising expert teams and a procurement framework:

- the Support Team, an expert team providing the end to end support needed to get projects up, running and successfully implemented
- the framework of suppliers, which saves time and resources for organisations that are procuring services and works.

They have been established to support the deployment of funds from the European Investment Bank, to provide loans taken out for improving energy efficiency in London. There may be similar support frameworks in your region, or you may wish to establish new services from scratch.

CARES in Scotland is a revolving fund for energy efficiency projects. Its technical assistance offer is to either add the cost to the loan if the project does receive finance, or turn it into a grant if the project proves unviable. This helps project owners to overcome the uncertainty regarding the outcome when embarking on the development of a project.

4. Implementation finance

Where might the money to pay the costs of a 4DHC project come from?

DHC projects are often municipally owned, or backed (in the case of a wholly or jointly owned ESCo). Cash or a loan from that source will be the cheapest source of finance. However, there are times when it is necessary (insufficient reserves or borrowing capacity) or prudent (to share risk) to use external finance. This may come in a variety of forms:

- Loans. Debt that has to be repaid, usually with interest.
- Grants. Desirable because it does not require repayment. However, it is likely to form only a small part of the project costs. European Regional Development Funding has been used extensively in energy projects.
- Developer contributions. Developers are often required, as a condition of planning consent, to contribute to the provision of infrastructure to serve the development, including energy networks.
- Equity. An external body purchases a share of the project (in return for a share of the profits).

In the case of DHC finance will be used for:

- New distribution infrastructure (to create or extend the service)
- New energy generation or distribution infrastructure (to create or extend the service or upgrading to renewable/low carbon energy)
- Installation of building fabric energy efficiency measures (such as insulation) to reduce energy losses and heating and cooling loads.

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4.1 Loans

4.1.1 Investment funds

There are a number of specialised energy efficiency investment funds, both public and private, offering equity or debt for projects.

Funds usually specialise, as the expertise needed to assess projects as investment opportunities is sector specific and expensive. A specialist energy fund is likely to assess and mitigate the risks inherent in an energy project more thoroughly and therefore be able to offer better terms (e.g. a lower interest rate) than a more general construction fund for example.

There are two key factors in securing finance from an investment fund:

- projects have to be sufficiently well developed (see section…..)
- projects have to be sufficiently profitable.

In the case of projects that are not sufficiently profitable to attract private investment, then they must turn to public financial instruments for help. There are many examples in the energy efficiency sector in which public funding, often ERDF, is used to adjust market failures and so bridge the viability gap. The EU has much guidance on the development and structuring of such funds (see FI Compass - an EU resource)

As well as direct finance there are secondary financing options such as forfaiting funds, bonds, YieldCos' and securitisation. There are a variety of mechanisms available in finance to help structure risk and so provide finance for projects which would otherwise not receive finance. They are technical and complex in their application and specialist advice should therefore be sought. A summary can be found at http://www.eefig.com/images/pdf/EEFIG_Underwriting_Toolkit_June_2017.pdf .

4.1.2 Private finance. There are commercial funds operating in the energy sector to which projects can apply e.g. Equitix NDEE http://www.equitix.co.uk/NDEE.html

There are some private financial intermediaries specialising in energy projects, e.g

- Joule Assets Europe;
- E-Quad platform.

4.1.3 Public finance. There are some government or EU investment funds, and some regions have set up their own investment funds (eg MLEI, Cambridgeshire, UK) targeting their own and associated property.

European institutional finance

There are a variety of sources of structural funding for investment in energy projects from the EU. Generally, they require a significant scale of investment and are difficult to access for one-off projects. To overcome this, regions often establish specialist financial instruments (including investment funds and project development support) and so act as an intermediary, effectively aggregating projects to achieve the necessary scale. The London energy efficiency fund is a regional example.

European Investment Bank framework loans. DHC examples

European Fund for Strategic Investments (Juncker Plan)

European Energy Efficiency Fund – e.g. Ore Valley Housing Association

Structural Funds within Financial Instruments – e.g. London Energy Efficiency Fund.

National and regional funding

Most member states recognise the strategic value of district heating and cooling networks in their transition plans to renewable energy. They also recognise the difficulties of establishing viable networks and provide various forms of support. The table below summarises what is available in each country in the HeatNet NWE project.

	UK - England	**UK - Scotland**	**IE**	**FR**	**BE**	**NL**
Project development grant	HNDU grant	Low carbon infrastructure transition fund	SEAI Project Assistance Grants	Climate Fund	Part of the "call groene warmte"	
Renewable heat subsidy	Renewable Heat Incentive: Domestic Non-domestic	Renewable Heat Incentive: Domestic Non-domestic		Le Fonds Chaleur en bref – Ademe	'call groene warmte', arranged by VEA - Vlaams EnergieAgentschap, 'ecologiepremie' arranged by VLAIO, Vlaams Agentschap Innoveren en Ondernemen Subsidies of 20 - 65% depending on heat source and type of investor REG-subsidies	www.rvo.nl

	UK - England	UK - Scotland	IE	FR	BE	NL
Capital grants	Heat Networks Investment Project		Climate Action Fund	The Heat Fund	The Climate Fund Ecologysupport+ Green Heat Grant	The Sustainable Energy Investment Grant (ISDE) The BNG Sustainability Fund
Low cost capital loans	Heat Networks Investment Project Salix	Salix The Energy Investment Fund District heating loan fund			PMV (Participatie maatschappij Vlaanderen) State owned bank Belfius, regional agent for the EIB.	www.rvo.nl
Other category			REFIT	Public Service Delegation System *Crédit d'impôt transition énergétique* – CITE	STRES "Strategic Ecologysupport"	https://www.rvo.nl/subsidies-regelingen www.refs.nu

See Annex 1 and 3 for more information on national and regional sources of finance.

State aid needs to be considered from an early stage, and legal advice sought where appropriate.

4.2 Energy Service Companies and Energy Performance Contracting

In the context of this guide, reference to energy service companies (or ESCos) is simply as a vehicle, for delivery of project finance (that is, finance to construct a DHC scheme). The governance of ESCos and their establishment is not covered here.

The basic principle regarding ESCos and finance is that the ESCo supplies an energy service. This may variously be an offer of energy supply (either reflecting market rates, or at a fixed price); a performance guarantee (guaranteed annual cost; guaranteed saving); 'comfort' a guaranteed temperature range;

etc. In doing so, the ESCo takes some performance risk (except in the case of simple energy supply, but in this case it is common that the ESCo owns and operates the energy generation and distribution infrastructure, which itself carries some performance risks).

Where a performance guarantee is involved, the term Energy Performance Contract (EPC) is used. This may or may not involve finance. Where it does, the proposition is normally that the energy savings cover the cost of the energy efficiency measures. The ESCo supplies and installs measures and often manages energy use, in return for a fixed fee or minimum energy saving. Their charges cover their operational costs, the cost of finance, and a profit margin. For more information on EPCs see:

- GuarantEE
- EuroContract
- Transparense

The role of an ESCo is to take on the responsibility for new DHC infrastructure, rather than the alternative of a public body such as a municipality. Private sector operation is less common because of the viability challenges of DHC networks.

Whilst there are many reasons why this may be desirable, in respect of finance there are two reasons why an energy user may want to make use of an ESCo rather than managing and operating the energy infrastructure itself:

- management of risk
- managing debt
- accessing finance from a third party (a large energy utility company for example).

Specialised energy service contracts that deliver finance come in a variety of forms, such as Energy Performance Contracts, Chauffage Contract, Energy Service Agreement, Power Purchase Agreement and so on. For more information see European Energy Efficiency platform https://e3p.jrc.ec.europa.eu/articles/energy-performance-contracting

4.3 Bonds (Green bonds, Social Bonds, Climate bonds, Municipal bonds)

A bond is an instrument of indebtedness of the bond issuer to the holders. Thus a bond is a form of loan or IOU: the *holder* of the bond is the lender (creditor), the *issuer* of the bond is the borrower (debtor). Bonds provide the borrower with external funds to finance long-term investments.

Green, Climate and Social bonds all fall into the category of ethical investing (or 'social investing', 'impact investing') in which investors aim to generate a positive social or environmental benefit as well as a financial return. Transparency is an important principle, so that investors can have confidence in the benefits claimed. This may mean additional verification requirements for projects funded in this way.

Bonds can be issued to raise any amount but transaction costs are fixed and it is uneconomic for smaller sums. Green Bonds are suitable, therefore, only for large projects or portfolios of projects. A small number of Municipalities have issued bonds for environmental projects, Gothenburg being the most notable (see case study http://greenfinanceinitiative.org/case-studies/the-city-of-gothenburg/).

More information:

- Green Finance Initiative
- Climate Bonds Initiative
- Report: The Green Bond Market in Europe
- Environmental Finance publication

As bonds tend to have long maturities, they offer lower rates of interest and are a cheaper form of finance for the issuer than, say, a bank loan. However, they have high transaction costs for the issuer, and are better suited to a portfolio of projects (to achieve scale in value) which generate stable long-term revenue streams.

4.4 Equipment finance. There are two types of equipment leasing, known as operating leases and finance leases, which offer a range of different timeframes and levels of commitment, depending on what equipment is needed. Equipment leasing has the advantage of ensuring the asset remains in good working order, with regular upgrades and servicing. It can provide tax and accounting advantages.

4.5 Crowdfunding. There are a number of crowdfunding platforms which promote investment opportunities for small, private investors. 'Abundance', for example, is one that is active in the renewable energy sector. They have been used to secure finance for a number of renewable energy projects (many solar and wind energy generation). Whether DHC projects would be regarded as too complex to market to such non-professional investors remains to be tested. On a small scale, investments give citizens a stake in local energy projects and an element of crowd-funding in a scheme may be seen as beneficial by some project owners.

Energy cooperatives are a form of crowdfunding as well. They give citizens a stake in local energy projects. In some cases they even invest in projects, which the government or private parties are reluctant to carry out.

4.6 Partnership funding. Projects can be financed by sharing the costs amongst a number of organisations, in a partnership approach. These arrangements can be referred to as Public Private Partnerships where private expertise and finance is involved. This is essentially equity finance in which each contributor takes ownership of a proportion of the project. A legal entity (a 'special purpose vehicle' or SPV) is normally established to enable this shared ownership. The SPV may or may not offer energy services (and so be referred to as an ESCo).

Further discussion on such approaches can be found in the Business Models section of the HeatNet Model.

5. Case studies from HeatNet NWE

Aberdeen Heat & Power

1. What DHC infrastructure (e.g. energy centre, distribution network) or institution (e.g. an ESCo) have you tried to finance?

A generator for the Linx Ice Arena, associated pipework and controls for connection to the network infrastructure. For this Aberdeen Heat & Power accessed a loan from the 'Scottish District Heating Loan fund' through the Energy Savings Trust.

2. What barriers have you experienced?

The initial loan requirements of £1m were greater than the regular maximum loan amount of £400k pounds. In order to comply with terms and conditions of the loan, £560K was required to be spent before the end of the first financial year, although the project was not at a stage that required expenditure. As a result, items were purchased for the infrastructure build that were placed in storage until the appropriate time that they were required. This led to the need to safely store items for almost 2 years until they were required, and the need to start paying off the loan capital. This meant that cash reserves for the company were reduced, as there was no revenue from the equipment, and paying back of the loan was being carried out without any income being generated.

3. Have you been successful?

Yes, the energy centre was built and is now operational.

4. If YES: what were the success factors; what lessons did you learn?

Once there is a project in place, make this a priority for workflow and demands. At the time, there were multiple projects ongoing, along with those that seemed critical due to customer demands. Timing and scheduling for availability of infrastructure and suppliers needs careful consideration at the start of the project.

6. What would you do differently in the future?

Would still use scheme for funding future opportunities. Any future projects would be prioritised to ensure that timing and application of loan would prevent potential cash flow issues.

Dublin - Codema

1. What DHC infrastructure (e.g. energy centre, distribution network) or institution (e.g. an ESCo) have you tried to finance?

The DH projects we have tried to finance involve both production plant and distribution network. We have not tried to finance an institution.

2. What barriers have you experienced?

The main barrier to finding finance for DH in Ireland is the low rates and long timeframes for return on investment. Commercial finance markets require high IRRs over short timeframes, which are available from other investment options in mature markets, and therefore DH projects are not an attractive investment. There are also multiple risks involved in the DH market in Ireland, which drives up the 'Weighted Average Cost of Capital' on any equity investments. There are no national level supporting regulations or legislation, and there are no guaranteed customers and therefore no guaranteed returns on investment. All of this means that DH schemes are only suited to public financing that comes with a low discount rate and which is open to longer timeframes for return on investment.

3. Have you been successful?

Yes and no. The projects have been successful at securing part funding from local authorities, but their budgets are limited and they have other priorities such as delivering housing (housing crisis in Dublin). Successful lobbying to the government department on climate action & environment means there is now a fund available

to renewable projects that includes District Heating for the first time. We are now hoping to be successful in our applications and receive the remaining funding we need.

4. If YES: what were the success factors; what lessons did you learn?
District heating networks need to be seen as a required public service infrastructure like other state-sponsored energy infrastructure such as gas and electricity grids. It is the infrastructure costs that are the real barrier; once there is a big enough network, the source of heat can be financed and run privately. We have been successful at convincing public authorities that financing at least the infrastructure is the responsibility of the state.

5. If NO: what were the main factors that you could not overcome?
The risks involved in DH in Ireland are not easily overcome; we cannot force customers to connect, therefore no guaranteed returns and higher IRR required, and we have to compete with a very low gas price meaning the revenues are not high enough to meet the high IRRs. The carbon tax on alternatives like gas need to be higher, therefore DH can be competitive, and more attractive to customers, which reduces risk and increases returns.

6. What would you do differently in the future?
Unfortunately, nothing could be done to overcome the barriers to attracting private financing; the barriers are a result of the existing energy market and the fact DH is a completely new market in Ireland. DH needs to be first proven in Ireland, through government support for 'pilot' schemes, which will allow the introduction of facilities to de-risk the market.

Heerlen

1. What DHC infrastructure (e.g. energy centre, distribution network) or institution (e.g. an ESCo) have you tried to finance?
We have financed the expansion of our cluster D (Hoensbroek). In particular the energy plant of the multifunctional centre of Hoensbroek, cluster basement with construction and piping between the backbone, cluster basement and the building.

2. What barriers have you experienced?
Earlier plans for Cluster D using industrial waste heat had been delayed. For various reasons, the initial customers had not been ready for investments to start exchanging energy. The situation has improved again and the Hoensbroek multifunctional centre became a clear potential customer. The grant from the HeatNet project came at the right moment to help get the Cluster D project started again.
In the realisation phase, we decided that we needed to select different pumps and heat exchangers compared to the previous design. This increased the investment costs.

3. Have you been successful? YES
We could use most of a previous engineering design, which simplified the engineering work.

4. What would you do differently in the future?
Start and finish the engineering phase on time and involve the maintenance department in this process.

Kortrijk

1. What DHC infrastructure (e.g. energy centre, distribution network) or institution (e.g. an ESCo) have you tried to finance?
District heating network (small) therefore financed with funds of the City Council.

2. What barriers have you experienced?
Barriers afterwards, in extending this network.

3. Have you been successful?
Yes

4. If YES: what were the success factors; what lessons did you learn?
The European project provided investment subsidies which were necessary for the City to proceed.

5. What would you do differently in the future?
Perhaps more information was needed for the City Council to see the bigger picture of a bigger district heating network.

Boulogne Sur Mer

1. What DHC infrastructure (e.g. energy centre, distribution network) or institution (e.g. an ESCo) have you tried to finance?
Energy Centres and distribution network.

2. What barriers have you experienced?
Most of the time some expenses are ineligible: main boiler room construction, engineering. Subsidies can be capped.

3. Have you been successful?
Yes, about 50% of the overall project (not just extension)

4. If YES: what were the success factors; what lessons did you learn?
It is crucial to have more than 50% renewables. Meeting the financer BEFORE the project.

5. What would you do differently in the future?
Find more funders BEFORE the project.

Plymouth

1. What DHC infrastructure (e.g. energy centre, distribution network) or institution (e.g. an ESCo) have you tried to finance?
We have secured some funding and applying for other funding to deliver the distribution pipework, the energy generation plant and some thermal storage associated with the Civic Centre scheme.

2. What barriers have you experienced?
We have had to explore a mix of funding that works within the constraints of state aid, but also with the criteria related to each source of funding. The initial scheme is sub-economic and therefore needs some grant funding, but is operationally viable. As the scheme expands the returns improve. It is therefore a balance between commercial certainty and optimum economics. Therefore Plymouth City Council will utilise public sector grant and loan funding for the initial phase of the scheme but in the longer term, the private sector may also bring finance to the scheme. In terms of the government funding available through the Heat Networks Investment Project, it has taken a while to get clarity about some of the funding criteria and intervention rates, which has affected our funding strategy.

3. Have you been successful?
Some funding already secured, that can help to de risk the scheme. Some of this is secured through the planning process for new developments, towards delivery. Other funding is being applied for.

4. If YES: what were the success factors; what lessons did you learn?
In terms of securing funding through the planning process with new developments, it was important to have a strong planning framework and evidence base to support this, including details of the wider scheme proposals.

5. What would you do differently in the future?

The funding mix, and ratio of grant to loan will need to be evaluated at an early stage in terms of state aid. Early advice is important. Drawdown times for loans will also be important to minimise any liability if occupation is delayed.

Top tips from HeatNet NWE

- Understand the needs of the funder and develop the project to a high standard accordingly.
- Focus on developing revenue streams (costs savings, energy sales, subsidies) as these are vital to attract finance
- High quality data on energy use/generation helps to predict revenue accurately and provide greater confidence to investors.
- Use standardised approaches to project development (such as Investor Confidence Project protocols).
- Understand risks inherent in the project, and use the full range of mechanisms available to mitigate risk.
- Make full use of grants, subsidies and own capital to develop the project to a high standard and to lessen the need for capital finance.
- Consider partnering (with experienced network operators/ESCOs) to share and reduce risk.

Annex 1: National and regional sources of project development finance

UK

Carbon and Energy Fund. A commercial project development and assurance service paid for as a % of project cost.

England

Heat Networks Delivery Unit**.** Provides grant aid for project development and is the leading source of project development resource for district heating.

Other options, targeting energy efficiency projects in general:

Re:fit Local Partnerships. The procurement framework follows an energy performance contracting approach, so it is possible to procure a provider that will do the project development work for you.

Scotland

Low Carbon Infrastructure Transition Fund**.** Provides a range of support from expert advice to grant funding to assist the development and delivery of private, public and community low-carbon projects in Scotland.

France

Aid from local authorities

Regional and departmental councils provide financial support for the construction of district heating networks as part of their local renewable energy support policies. Public authorities can pool together skills and services. Some departmental energy unions also provide methodological support to municipalities.

Depending on the management system, DHC can be funded as such:

1) Self-financing of the public authority (depending on its capacity)
2) European aid:
    a. Framework programs (Horizon 2020, LIFE);
    b. Structural Funds (ERDF, EAFRD);
    c. Intermediated loans from the European Investment Bank, ELENA scheme;
3) National aid:
    a. ADEME Heat Fund;
    b. Local Investment Fund (called Dotation de Soutien à l'Investissement Local for public authorities);
    c. Future Investments Program (PIA);
    d. Cash-back loans from Caisse des Dépôts, fueled by the "green growth" envelope;
    e. Money from the Energy Transition Financing Fund for the public authorities who has been awarded the positive energy territory label;
4) Regional aid:
    a. Regional State Plan Contract Fund

All those funding can be accessed if DHC fuelled with at least 50% of renewable energy.

Belgium

Flanders: PMV participatiemaatschappij Vlaanderen: http://www.pmv.eu/nl/investeringen-infrastructuur-en-vastgoed/energie tom.mortier@pmv.eu

Ireland

Energy Project Assistance Grants: https://www.seai.ie/grants/business-grants/project-assistance-grants/

Netherlands

Topsector Energy studies Industry grant: https://www.rvo.nl/subsidies-regelingen/topsector-energiestudies-industrie

Annex 2. Sources of project development guidance

A guide to heat network delivery from Greater London Authority
https://www.london.gov.uk/sites/default/files/london_heat_map_manual_2014.pdf

A basic and accessible guide to the key steps in developing renewable energy projects
http://www.nordicenergy.org/wp-content/uploads/2017/03/Guide-report-4-The-project-development-process.pdf

This guide is more strategic, targeting public sector planners
https://www.stepupsmartcities.eu/Portals/51/Developing%20sustainable%20energy%20projects.pdf

Designed for community renewable energy projects, but nevertheless has some useful tools
https://www.localenergy.scot/resources/cares-toolkit/

A simple guide to heat network project development for community energy organisations
https://hub.communityenergyengland.org/resources/resource/151/community-led-heat-projects-a-toolkit-for-heat-net/

A summary of the CIBSE Code of Practice for HeatNetworks which covers aspects of project development
http://www.cibse.org/getmedia/d2b9f422-01b7-434e-9e99-488fccefe891/CP1-A-guide-for-owners-v4.pdf.aspx

A guide specific to the UK and to combined heat and power plants in DHC schemes, but illustrating the complexities of selling energy in a regulated market

France

Develop the heat supply from the anaerobic digestion: http://reseaux-chaleur.cerema.fr/wp-content/uploads/2018/05/180319_Dvper_offre_chaleur_methanisation.pdf

Understand the state of DHC and study their potential development: http://reseaux-chaleur.cerema.fr/wp-content/uploads/Cerema_guide_RdC_region_2017_vf.pdf

How to create a Heat Network:

https://www.ademe.fr/sites/default/files/assets/documents/creer-reseau-chaleur-guide-technique-2017.pdf

CHP and DHC:

http://www.amorce.asso.fr/media/filer_public/a6/1f/a61fb8b7-6bc6-4cb8-b495-42d0fb7c0171/rct43_ent27-cogeneration_en_france_et_reseaux_de_chaleur.pdf

Roadmap for existing DHC - implementation guide

http://www.amorce.asso.fr/media/filer_public/83/b8/83b8485a-c9d4-433d-8af9-50eb742fb36d/guide_schema_directeur_v41.pdf

Technical challenges of Heat Distribution:

http://www.amorce.asso.fr/media/filer_public/97/99/9799e608-ea00-4fe2-9683-135c91914275/ent_20_distribution_denergie_-_enjeux_techniques.pdf

Legal and strategic tools:

http://www.amorce.asso.fr/media/filer_public/1b/17/1b179b66-fa91-4865-9e02-40861b7d55d9/rct_40_-_densifier_son_reseau_de_chaleur.pdf

Belgium

https://www.ode.be/images/warmtenetten/leidraad%20gemeenten/EnergielandschapToolkitWarmtenetten%20[web].pdf

Annex 3: National and regional funding sources

UK

Salix Finance. Salix Finance provides interest-free Government funding to the public sector to improve energy efficiency, reduce carbon emissions and lower energy bills. Salix is funded by the Department for Business, Energy and Industrial Strategy, the Department for Education, the Welsh Government and the Scottish Government and was established in 2004 as an independent, publicly funded company, dedicated to providing the public sector with loans for energy efficiency projects.

England & Wales:

Heat Networks Investment Project, providing grants loans and other mechanisms to finance DHC projects https://www.gov.uk/government/publications/heat-networks-investment-project-hnip

A range of barriers are impeding the development of good quality heat network projects and therefore market growth in the UK. These include:

- a lack of information on the risk profile of heat network investment, which adversely affects investor perceptions of risk
- a funding gap between hurdle rates and project internal rates of return
- lack of understanding of the technology by end users, and o an underdeveloped supply chain.

The Heat Networks Investment Project is a Government Major Project, which will invest £320m of capital funding in heat network projects through grants and loans. This is provided as 'gap funding' to grow the UK heat networks market, overcome the barriers stated above and deliver the cost effective carbon savings required to meet our future carbon reduction commitments.

Funding offered through HNIP seeks to leverage in around £1bn of private and other investment, to support the design and construction of heat networks. The Government's investment aims to kick start the heat networks market, driving down costs, improving skills and capability, and demonstrating to investors that heat networks are a viable proposition in the UK context. The overall aim is for the market to be self-sustaining without further direct Government subsidy post-2021, and to increase the long term growth rate of the market.

Scotland:

District heating loan fund http://www.energysavingtrust.org.uk/scotland/grants-loans/district-heating-loan .

The Energy Investment fund, https://www.gov.scot/policies/renewable-and-low-carbon-energy/energy-investment-fund/, loans or equity investments. Awarded where there is an evident gap in the funding of an energy project, which would prevent project completion. Also aims to increase community benefits and community investment in commercial schemes.

France:

Aid from the State

Created in 2009, the French heat fund (Fonds Chaleur) aims to finance renewable heat projects in collective housing, tertiary sector and industry. It is a grants for local projects managed by the French Environmental Agency (ADEME) when:

- The grid will have to be supplied by more than 50% of renewable energy;

• It implies a program of up to 5 years of investment and a densification of 200ml of cumulative trench at least;

• The application must be supported by a network-wide master plan or feasibility study and be supported by a commercial and technical strategy.

• It will be necessary to explain the expected impact mechanisms of the financial benefits of densification to subscribers.

Moreover, since 2006, the VAT rate applied to the heat of the networks supplied mainly by renewables is 5.5% instead of 19.6%. This enhances the attractiveness of this mode of heating for users and provides additional leeway to make investments while maintaining the competitiveness of the network.

Other schemes can contribute to the economic balance of a heat network project. The mechanism of regulated electricity purchase tariffs provides additional income for the heat network operator when for example it is equipped with a cogeneration unit. Certain work operations make it possible to obtain energy performance certificates, which can be valorised financially.

Belgium:

Call 'groene warmte' Vlaanderen

https://www.energiesparen.be/groene-energie-en-wkk/professionelen/steunregeling/call-groene-warmte-restwarmte-en-biomethaan

Ecologysupport+ Ecologiepremie+ | Agentschap Innoveren en Ondernemen

Entrepreneurs in the Flemish Region can obtain grants from the Agency of Innovation & Entrepreneuring for investments in certain environment- and energy saving technologies, CHP, and renewable energy.

Climate Fund Vlaamse Regering keurt oprichting Vlaams Klimaatfonds goed | Vlaanderen.be

This fund aims to finance the "Vlaams Klimaatplan 2013-2020". This plan contains measures to respond to climate change.

Green Heat Grant Investeringssteun groene warmte, restwarmte en biomethaan | Agentschap Innoveren en Ondernemen, Call groene warmte, restwarmte, warmtenetten en biomethaan - Energiesparen

Flemish government provided extra financial support within the frame of the Flemish Action Plan for Green heat. There will be an increased ecological support for technologies that focus on green heat and waste heat. This is an investment support with a yearly budget from the Flemish Government.

Ireland:

Climate Action Fund: https://www.dccae.gov.ie/en-ie/climate-action/topics/climate-action-fund/Pages/default.aspx

Disruptive Technologies Innovation fund: https://dbei.gov.ie/en/What-We-Do/Innovation-Research-Development/Disruptive-Technologies-Innovation-Fund/

Support Scheme for Renewable Heat: https://www.seai.ie/sustainable-solutions/support-scheme-renewable-/

Netherlands

Grants of the Topsector Energy
https://www.rvo.nl/sites/default/files/2019/03/Kenmerken%20per%20regeling%202019.pdf:

- Urban energy grant (https://www.rvo.nl/subsidies-regelingen/urban-energy)
- Multi-year Mission-driven Innovation Programs - MMIP (https://www.rvo.nl/subsidies-regelingen/meerjarige-missiegedreven-innovatie-programmas)
- Geo-energy (https://www.rvo.nl/subsidies-regelingen/subsidies-energie-innovatie-topsector-energie/geo-energie)
- Renewable energy grant (https://www.rvo.nl/subsidies-regelingen/hernieuwbare-energie)

SDE+: https://english.rvo.nl/subsidies-programmes/sde

The Sustainable Energy Investment Grant (ISDE) gives you an allowance for the purchase of solar boilers, heat pumps, biomass boilers and pellet stoves. The scheme is for both private individuals and business users: https://www.rvo.nl/subsidies-regelingen/investeringssubsidie-duurzame-energie-isde

Some provinces might give grants or revolving funds for local energy transition initiatives:

- Brabant Energy Fund: € 60 million for projects aimed at saving energy and generating sustainable energy.
- Innovation fund Brabant: € 125 million to offer financing together with private investors to SMEs that innovate in the areas of high-tech, lifescience, biobased economy, agri-food, logistics, maintenance, care, smart mobility, and rural areas. Or for innovative proposals in the leisure or creative sector: http://www.bom.nl/"www.bom.nl

Regional support

Regional Energy Funds:

- https://www.refs.nu
- https://www.noord-holland.nl/Loket/Producten_en_Diensten/Producten_op_alfabet/W/Warmtetransitie_gebouwde_omgeving_op_wijkniveau_Noord_Holland_subsidie
- https://www.zuid-holland.nl/@16784/energietransitie/

The BNG Sustainability Fund
https://www.bngduurzaamheidsfonds.nl/"https://www.bngduurzaamheidsfonds.nl

The BNG Sustainability Fund finances business projects that contribute to the sustainability goals of municipalities or provinces. It thus contributes to a future-proof, energy-neutral society. The BNG Sustainability Fund is an initiative of BNG Bank and is supported by the Association of Dutch Municipalities.