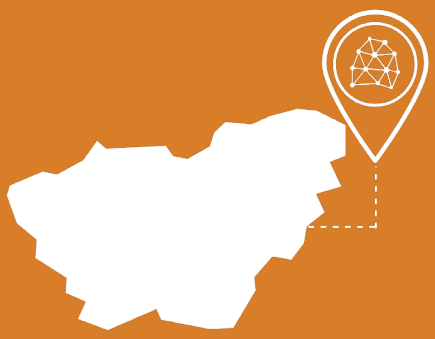
South Yorkshire low carbon energy supply chains: Heat Networks sector summary



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1. INTRODUCTION

This sector summary focuses on the potential and challenges for the heat networks sector in South Yorkshire. It sets out existing UK policy on heat networks and outlines the current state of the sector, before exploring heat network supply chain, employment and skills within South Yorkshire. Findings are based on a review of policy literature, existing research and interviews with 10 industry stakeholders (including installers, manufacturers, accreditation and industry bodies). This summary forms part of a wider study of six energy sectors (carbon capture and storage, insulation, heat networks, heat pumps, hydrogen and small-scale nuclear). An outline of overarching findings from the study is published alongside these sector summaries and can be found here [hyperlink to summary report].

The report is based on findings from review of policy literature and in-depth interviews with 12 heat network industry stakeholders. These include policy professionals, national sector associations, energy companies, consultants, and heat network operators in South Yorkshire

We found that there is potential for job creation through construction of new heat networks in the region. Most jobs will be in construction phases and relatively short-term – one important aspect will be to ensure that any local employment gains are maintained through linking into other large development projects or by sequencing heat network development across the region.

There are some skills shortages that create challenges for new developments, which are shared with other sectors requiring construction and engineering skillsets and not limited to the energy sector. The heat network industry in the UK is not mature, especially when compared to other northern European nations. This puts UK firms at a disadvantage for competing for heat network development, operation and consultancy.

2. BACKGROUND

Although there has been government investment in heat network development over the last decade, the heat network sector in England is immature.[1] Currently heat networks provide just 2% of the UK's heat demand (compared to 50% in Denmark), but this could grow to 20% by 2050.[2] If low carbon energy sources are used to generate energy, they could play an important role in decarbonising heat in the UK. Low carbon heat sources for heat networks include:

- Combined Heat and Power using low carbon fuels (currently biomass and energy from waste are considered as low carbon, although this might change as decarbonisation legislation tightens to achieve net zero).
- Heat pumps: large heat pumps to produce heat for a network, currently limited in capacity compared to other heat sources; or individual dwelling pumps used in conjunction with low temperature networks (see '5th generation' below).
- Waste heat from industry, commerce (e.g. data centres, supermarkets) and infrastructure (waterways, sewage treatment, metro systems).

1 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/919521/heat-network-skills-review.pdf
2 BEIS (2017) Clean Growth Strategy

- Geothermal: these can be ‘shallow’ or ‘deep’. On the whole shallow geothermal is more financially feasible and there are opportunities in parts of the UK for this. Minewater in abandoned coal mines is one example of shallow geothermal.[3]

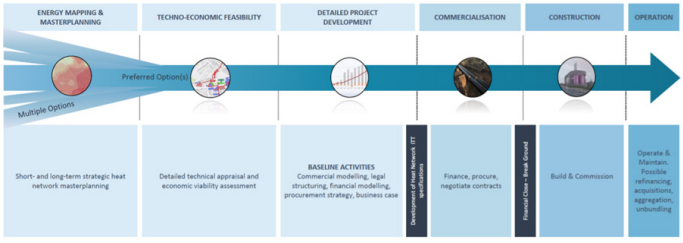
Heat networks have gone through stages of evolution characterised in five ‘generations’:

- 1st- and 2nd-generation networks (<1970) piped steam or pressurised hot water (over 100°C).
- 3rd generation networks (1970s onwards) use pressurised hot water (70-100°C). This is the most prevalent form of heat network in the UK today.
- 4th generation networks use lower temperature water (40–60°C). These networks can more easily taken on different heat sources; and lose less heat.
- 5th generation networks (or ‘ambient loop systems’) recently began to emerge as a feasible alternative. These networks radically reduce heat loss by using water close to ambient ground temperature, reducing need for pipe insulation. Buildings on these networks then use their own heat pump to raise the temperature of water for heating. Heat pumps can also be used to put heat back into the network and cool the building. These networks can support a range of low-carbon heat sources.[4]

3. SECTOR PROFILE

Heat networks are relatively complex infrastructure, involving a variety of processes to reach operational stage. Figure 1 outlines different stages of heat network development, each requiring different expertise.

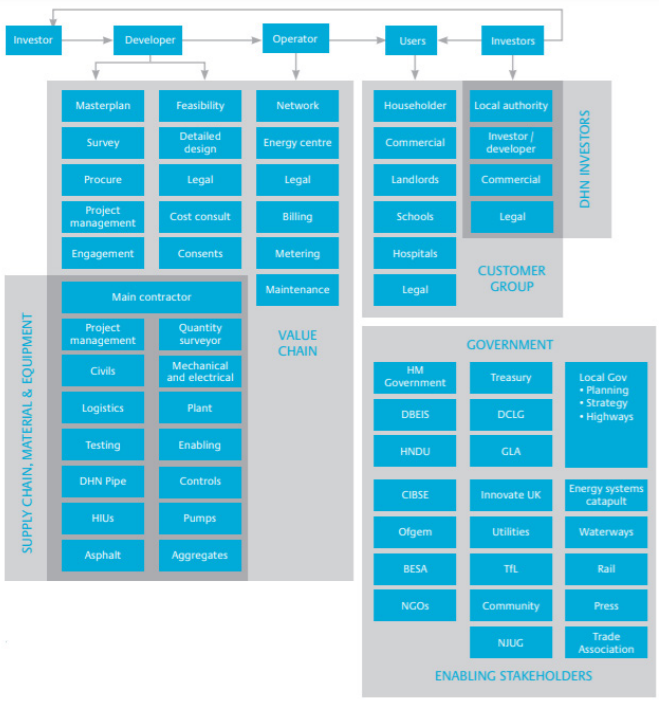
Figure 1: Stages of heat network development



Source: BES (2020) Development of heat networks in the UK.

Overall, the heat network sector and supply chains are relatively fragmented, incorporating a wide range of stakeholders throughout the development process (see Figure 2).

Figure 2: Stakeholder map for UK district heat networks



Source: ETI (2018) District heat networks in the UK potential, barriers and opportunities. https://d2umxnkyjne36n.cloudfront.net/insightReports/District-Heat-Networks-in-the-UK-Final.pdf?mtime=20181105145836

Throughout stages up to the point of construction the supply chain consists of various different forms of professional services (e.g. planning, finance and commercial, compliance, legal, design). Over the last ten years expertise has grown within the UK but international consultancy firms like Ramboll, Aecom and Arup dominate the provision of expert consultancy to local authorities, which are commonly the organisations instigating new developments. Development and operation is also limited to a relatively small number of new firms with accrued experience and expertise: Vital Energi, Vatenfall and Veolia cited as the most active at the moment.

There is little information available on companies operating within district heat component supply chains but – for example – there are a small number of companies which dominate the district heating pipe market, including Danish company Logstor and

3 https://researchbriefings.files.parliament.uk/documents/POST-PN-0632/POST-PN-0632.pdf
4 https://researchbriefings.files.parliament.uk/documents/POST-PN-0632/POST-PN-0632.pdf

its partner business Power Pipe, based in Nelson, UK. There is some consolidation taking place in the sector with – for example – Vital Energi and Logstor striking up partnership through a new Vital Energi training centre in Blackburn. Respondents did not know of any active supply chain companies in South Yorkshire, despite technical capabilities for specialist steel manufacture.

Despite the sector's small size relative to other northern European countries, decarbonisation goals, changing energy economics and government incentives have led to local authorities across the UK exploring potential for new heat network developments. According to the BEIS Heat Network Project Pipeline, as of June 2021, £1.3 billion worth of projects were in the heat network pipeline, of which £230 million was under construction.

A such the heat network sector in the UK is still relatively undeveloped but with growth potential: *I would say it's still emerging, it's still quite a young sector … growing and potential for growth is definitely in there, quite a few established players but quite a few new market entrants (HN01). Another respondent made similar comments: "there isn't really, in terms of the supply chain, it needs building up from scratch really because it probably doesn't exist" (HN03)*. This wasn't necessarily seen as a significant barrier to heat network development, but it did create some cost pressures and reduce the potential local economic benefits of new developments, as developers bring in resource from elsewhere. Respondents talked about the need for long-term local strategy and investment planning to provide the conditions for developing local supply chains for heat decarbonisation more broadly, which might include heat network specialisms.

Reflecting the relatively undeveloped heat network market in the UK, investments – usually in some form of partnership with local authorities – tend to come from large international companies with a base in other European companies where heat networks are more prevalent. Outside South Yorkshire, in October 2020 the Department for International Trade announced that the North East and Tees Valley would receive funding through its High Potential Opportunities scheme to support efforts to attract inward investment for heat network supply chains.

BEIS data on the heat network pipeline only includes one heat network development project in South Yorkshire: the Barnsley town centre network, listed as 'not being actively pursued'. Although the initial project outline included use of gas-fired CHP units, plans for the Barnsley network included exploring potential for using mine water from abandoned coal mines in the area as a heat source. Barnsley Council continues to explore the options for this. Proposals for a district energy system making use of an existing biomass power plant in Rotherham have also recently been put on hold but might be resurrected later. Sheffield has two established heat networks in the town centre and Don Valley respectively. The Sheffield city centre network lays claim to being one of the largest in the UK. There are also numerous small-scale systems across South Yorkshire (e.g. communal heating for blocks of flats).

Longer term there are questions about the continuing viability of energy from waste or biomass in a zero carbon transition. This means that existing plants are beginning to think about alternative operating models post-2030.

4. EMPLOYMENT AND SKILLS

The potential growth in the heat network industry creates employment opportunities. There are no existing figures on employment numbers in the heat network industry, but Heat Network Industries Council (HNIC) claim that expansion of the sector to meet 18% of UK heat demand by 2050 could create 20,000-35,000 direct jobs.[5]

Most jobs are in the construction phase, requiring construction and engineering skills. CHP plants and heat networks tend not to have large staff numbers but they do require on-going maintenance (usually by sub-contractors) and create indirect jobs in energy supply – e.g. waste wood or household waste collection. An outline of how the workforce composition changes over the development course is shown in Figure 3, below.

During the development stages, contractors on large projects tend to be national suppliers who then might sub-contract to local labour or hire local people in response to specific needs. Local authorities are able to use social value act and planning regulations to mandate use of local labour

5 https://www.heatnic.uk/

and employment support in new developments. Some local authorities worry that pushing strongly on these will stifle development, but there is no clear evidence to support this, and such conditions are unlikely to significantly alter the business case for new developments.

The two existing large district heating schemes in Sheffield are well-established and not currently looking to extend so employment levels are quite stable. For the Sheffield City Centre heat network there is a small team of four people who manage the network, alongside a larger team of 42 managing and operating the Energy Recovery (energy from waste) Facility (ERF), plus a small number of contractors. Waste collection to feed the ERF is managed by a separate arm of the business. The E.ON Blackburn Meadows site has a team of 24: two managers, an operations team of 18 plus four engineers responsible for maintenance, and use of contractors to carry out any works needed on site. Provision of waste wood for the biomass plant is provided by a local external contractor, which sources wood from around the South Yorkshire and Nottinghamshire region. The waste wood market is competitive, and alongside smaller local suppliers there are also large companies like Stobart's who operate at a wider geographic scale. At the same time demand has grown in recent years so prices have increased too.

Strategic management functions and R&D for heat networks is generally based with operators' headquarters: for instance Veolia's main heat networks hubs are in the EU. But there are some research specialisms in regional universities – for instance Sheffield Hallam University has a history of working with regional businesses on heat transfer research and application, which can be also applied for district heating. There is growing research on developing mine water heat applications, and the University for Sheffield developed some capacity and expertise on this theme.

Like other energy sub-sectors heat networks have a diversity problem: "it's an older, while male dominated industry … at the moment it's seen as a very closed industry", (HN01), although other respondents said that that the perception of a 'closed shop' did not match the reality. Rather, they felt that the sector was not well understood as a potential employment route, which exacerbated Equality, Diversity and Inclusion (EDI) challenges. There was need to promote the energy sector as a potential career choice to young people to build a more diverse labour supply.

The industry is good at training from within. Most of the people we spoke to talked about their positive experiences of support for training and career progression, in one instance beginning as an apprentice and within 10 years holding a senior position in a large heat network: *"It's quite common in the power industry to start at 16 in an apprenticeship and work your way through the ranks" (HN04)*. Apprentice schemes were seen as critical to ensuring development of the right skillsets for business needs. E.ON and Veolia both have their own dedicated training teams within the UK and do not use local providers. Campus Veolia is based in Wolverhampton.

A major challenge is that the most in demand professions are also in demand for a variety of energy infrastructure transition sectors, with skills shortages documented across the different sectors covered in this study. The Construction Industry Training Board (CITB) suggest the following heat network skillsets are in particularly short supply:

- Strategic level project planners.
- Engineers and developers.
- Design engineers and control systems / Programmable Logic Controller (PLC) specialists,.
- At an installation level, welders and general installers (a need for specific welding skills beyond basic Level 2 qualifications was also cited by a respondent involved in a new heat network development).

There are also challenges earlier in the development process, which relate not just to the existence of expertise, but where that expertise can be found. Local authorities are central to development of new district energy schemes. But as one study put it, *'[UK] local authorities often do not have the capacity or expertise to take a feasibility study from a consultant … and take it through the highly complex commercialisation stage and into project delivery'* (Swedish Energy Agency, 2016 p.16).

As the sector seeks to increase from 2% of heat demand to up to 20% (or more) these shortages become more challenging to overcome. It was also suggested by one respondent that the decline of workers from EU countries, as a result of Brexit, has exacerbated skills shortages and reduced the potential labour pool for expansion of the sector.

Based on estimated growth trajectories for the sector, CITB estimate a need for rapid and

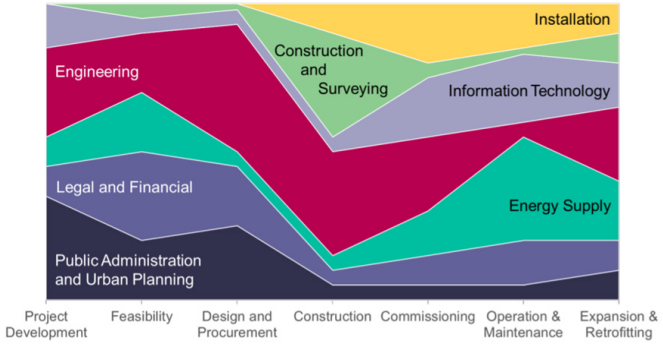
immediate growth in skills provision, with continued growth over the next decade before a decline in requirements as the sector matures and the numbers of new developments begins to plateau or decline (see Table 1, below).

Table 1: Heat networks skills summary

Timeframe	Skills Summary
1-4 years	Significant additional training capacity: 9,500 average additional FTE per year, including predominantly specialist and technical skills
5-10 years	Reduction in rate of training to 866 average additional FTE per year
10 years +	Reduction in numbers required – 1,200 per year

Source: CITB (2021) Skills for net zero, available at https://www.citb.co.uk/media/kkpkwc42/building_skills_net_zero_full_report.pdf

Figure 3: Heat network project stages and skills/role requirements



Source: BEIS (2020) Heat Networks Skills Review. BEIS, London.

Association for Decentralised Energy (ADE) research for BEIS[6] confirmed that most existing training provision is provided informally or on an ad hoc basis within heat network organisations. But there are various local heat network skills initiatives across England and Scotland, often linked to new heat network development, most of which opened within the last few years. These include:

- Stoke-on-Trent – qualifications delivered by Stoke College, initially in partnership with Nordic Heat's Heat Academy but since expanding to work with other partners.[7]
- Blackburn – £2m training centre at Vital Energi's UK HQ, in partnership with City of Liverpool College.
- Bridgend – Bridgend College, also in partnership with Heat Academy.
- Nottingham – the Uniper Engineering academy, which includes courses for CHP operators and technicians.

The BEIS skills review also found limited provision within Higher Education: relevant degrees like Mechanical Engineering tend only to include one module applicable to the heat network sector, on heat transfer. There is a need for long-term planning with local skills providers to map out likely skills needs through different phases of heat decarbonisation (or energy decarbonisation more widely).

Despite these skills gaps for heat network development, district heating operators said that they did not have problems recruiting to operational roles. They pointed to the ability to train up within the business, but also that there were lots of transferable skills from heavy industry, at least for CHP operations.

4. WHAT CAN SYMCA DO?

For SYMCA, as for heat pumps and insulation, the overarching recommendation is to orientate investment and policy coordination towards development of a low carbon heat technology ecosystem for the region. Specific recommendations include:

- There is a continued need for investment and support from SYMCA for new heat networks, including those that appear to have stalled. Although urban heat demand is predicted to fall over the coming years there will still be a place for heat networks, especially 4th and 5th generation low temperature networks.
- Respondents talked about a lack of awareness about district heat networks from potential customers, both at an individual and organisational level: SYMCA, local authority partners and heat network developers and operators should work together to ensure greater citizen and organisational engagement with district heating. This could be part of wider engagement about energy transition, including

6 BEIS (2020) Heat Networks Skills Review. BEIS, London https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/919521/heat-network-skills-review.pdf
7 https://heatacademy.eu/

a programme of outreach into schools to help promote diversity in the energy sector.

- SYMCA should work with local authorities and anchor institutions to ensure that social value provisions within procurement and planning conditions for any future developments include strong commitments to local employment and supporting those marginalised by the labour market to gain employment, including through apprentices for young people.
- Any employment gains will need to be sustained by linking together heat network pipeline projects and/or linking jobs gained in construction phase to other large infrastructure projects once construction is complete.
- In the short-term, if new projects in Barnsley and Rotherham do regain momentum, SYMCA and partners should explore possibilities for heat network training provision in Barnsley and Rotherham Colleges, working in partnership with developers and energy providers. Given Barnsley College already has some provision around environmental technologies it would seem on the surface to be well placed to support such provision. Nordic Heat has led development of courses in other places, and has a base in South Yorkshire, so would be well placed to provide some support.
- There is also a need for a longer-term zero carbon skills plan/strategy for South Yorkshire, which maps out skills needs over time across different phases of decarbonisation. Heat decarbonisation will be an important element of this plan.
- Although not certain to produce immediate gains, it would be worthwhile scoping Sheffield-based steel manufacturing capabilities to engage in heat network component supply (e.g. for pipes). The supply market appears relatively settled at present but expansion in demand across UK could create opportunities for new suppliers.

Other Reports

- Low Carbon Energy Supply Chains, Employment and Skills in South Yorkshire: Headline Findings
- South Yorkshire low carbon energy supply chains: Carbon Capture, Utilisation and Storage (CCUS) sector summary
- South Yorkshire low carbon energy supply chains: Heat Pumps sector summary
- South Yorkshire low carbon energy supply chains: Hydrogen sector summary
- South Yorkshire low carbon energy supply chains: Insulation sector summary
- South Yorkshire low carbon energy supply chains: Nuclear sector summary

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