

# Outline Business Case, Cambridge City Centre Heat Network



21 Strategic Partners



Project management



Commercial & Financial Advisors



Technical consultants



Legal consultants



## CHANGE HISTORY

| Version No. | Date       | Details of Changes included in Update  | Author(s)  |
|-------------|------------|--|--|
| 1           | 22/04/2025 | Basic template for Cambridge   | DESNZ  |
| 2           | 20/10/2025 | Strategic Case (v2)  | Sustainability Co.                               |
| 3           | 14/11/2025 | Strategic Case (v3) and Economic Case (v2)   | Sustainability Co.                               |
| 4           | 18/11/2025 | Combined Strategic Case (v3) and Economic Case (v2)  | Sustainability Co.<br>Buro Happold               |
| 5           | 02/12/2025 | Combined Strategic Case (v4) and Economic Case (v3)  | Sustainability Co.<br>Buro Happold               |
| 6           | 18/12/2025 | Management Case (v2)   | Sustainability Co                                |
| 7           | 12/01/2026 | Combined Strategic Case (v5) and Economic Case (v4)  | Sustainability Co<br>Buro Happold                |
| 8           | 14/01/2026 | Management Case (v3)   | Sustainability Co                                |
| 9           | 22/01/2026 | Combined Strategic Case (v6) and Economic Case (v5)  | Sustainability Co<br>Buro Happold                |
| 10          | 24/01/2026 | Management Case (v4)<br>Commercial Case (v2)   | Sustainability Co<br>Amberside                   |
| 11          | 15/01/2026 | Commercial Case (v3)   | Amberside  |
| 12          | 27/01/2026 | Commercial Case (v4)   | Amberside  |
| 13          | 27/01/2026 | Financial Case (v2)  | Amberside  |
| 14          | 28/01/2026 | OBC: combined Strategic Case (v6), Economic Case (v6), Commercial Case (v4),<br>Management Case (v5) and Financial Case (v2) | Sustainability Co, Buro<br>Happold and Amberside |
| 15          | 18/02/2026 | OBC: combined Strategic Case (v7), Economic Case (v7), Commercial Case (v5),<br>Management Case (v6) and Financial Case (v3) | Sustainability Co, Buro<br>Happold and Amberside |

**APPROVAL HISTORY**

| NAME      | ROLE   | DATE BUSINESS CASE APPROVED | VERSION APPROVED |
|-----------|--|-----------------------------|------------------|
| Ben Binns | Project Sponsor  |                             |                  |
|           | Core Group   |                             |                  |
|           | Steering Group   |                             |                  |
|           | Individual Institutions: <ol style="list-style-type: none"> <li>1. Cambridge City Council</li> <li>2. University of Cambridge</li> <li>3. Anglia Ruskin University</li> <li>4. Christ's College</li> <li>5. Clare College</li> <li>6. Corpus Christi College</li> <li>7. Downing College</li> <li>8. Emmanuel College</li> <li>9. Gonville &amp; Caius College</li> <li>10. Hughes Hall College</li> <li>11. King's College</li> <li>12. Pembroke College</li> <li>13. Peterhouse College</li> <li>14. Queens' College</li> <li>15. Jesus College</li> <li>16. Sidney Sussex College</li> <li>17. St Catharine's College</li> <li>18. St John's College</li> <li>19. Trinity College</li> <li>20. Trinity Hall College</li> <li>21. Cambridgeshire County Council</li> </ol> |                             |                  |

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# 1 Appendix List

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| C        | Risk Register  |
| D        | Steering Group Approvals, Detailed Project Development               |
| E        | Expert Advisory Group Recommendations                                |
| F        | College Queries, 4 June 2025   |
| G        | Heat Zoning Study, December 2025                                     |
| H        | Updated Future Proofing Guidance Note                                |
| I        | Concept Paper, Heat Network Digital Twin                             |
| J        | Network Architecture Assessment Matrix                               |
| K        | Heat Generation Technology Assessment Matrix                         |
| L        | Energy Centre Location Assessment Matrix                             |
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| O        | Techno-Economic Modelling Assumptions                                |
| P        | Counterfactual Modelling Assumptions                                 |
| Q        | Financial Modelling Assumptions                                      |
| R        | Resilience Note  |
| S        | Cashflows (Nominal £'000s) Over Project Lifetime                     |
| T        | Existing Heat Network Case Studies                                   |
| U        | Commercial Delivery Model Pros and Cons                              |
| V        | Draft Principles for Drafting Heads of Terms (Heat Supply Agreement) |
| W        | Programme, Pre-Commercialisation and Commercialisation               |

## 2 Executive Summary

### 2.1 Cambridge City Centre Heat Network (CCCHN) Strategic Partner Briefing

The Outline Business Case (OBC) for the Cambridge City Centre Heat Network has been developed by Cambridge City Council (lead partner), working closely with 20 Strategic Partners (University of Cambridge; 17 city centre University Colleges, Anglia Ruskin University and Cambridgeshire County Council). The OBC aims to answer three fundamental questions:

#### 1) Is the Cambridge City Centre Heat Network viable?

##### a) Does it deliver the project's Critical Success Factors (CSFs)?

i) *Yes. CCCHN delivers cost effective, reliable low-carbon heat, at a scale and in a timeline that's not otherwise possible. It provides an appropriate Cambridge response to the Climate Emergency.*

##### b) Is it value for money?

i) *The current local counterfactual assessment used in the OBC is conservative, with forecast cost comparisons within the Margin of Error. Work is underway with Strategic Partners to better understand the actual cost of delivering local decarbonisation projects in Cambridge, noting significant space and conservation constraints. To date, informal analysis has indicated that local counterfactual costs are likely underestimated. If true, this makes the heat network overall more cost competitive, creating additional headroom. As and when this information is shared and fully validated, we will update Strategic Partners.*

#### 2) Is there enough evidence for Strategic Partners in the Minimum Viable Product (MVP) to provide a strong intention to connect and commit to Commercialisation Stage?

i) *Yes. The Outline Business Case provides the supporting evidence base, assumptions and Sensitivity Analysis results for Strategic Partners to provide Letters of Support for the project's forthcoming Green Heat Network Fund bid. This is in principle commitment to connect and/or invest, and to continue to work in partnership with other Strategic Partners to support further project development during Commercialisation Stage. Although Strategic Partners can still change their mind before Final Investment Decision in summer 2028, withdrawing from the project at such a late stage is likely to impact both project viability and confidence.*

#### 3) For Strategic Partners considering investing in the project, what is the associated risk, reward and control?

i) *Extensive codesign with Strategic Partners has enabled development of an appropriate balance between risk, reward and control, which is fully described in the Business Case.*

Through individual formal governance review, Strategic Partners are asked to:

1. **Feedback on the draft Outline Business Case:** An updated version will be reissued to Strategic Partners for formal approval in Q2 2026
2. **Provide Letters of Support for the forthcoming Green Heat Network Fund (GHNF) bid using the template and headed paper.** The aim is to showcase the strength of the strategic partnership and associated heat demand. This is key to unlocking £20 million of grant funding, including up to £1 million Commercialisation funding, both of which are essential to project viability.
3. **Sign the updated and non-legally binding Memorandum of Agreement (MOA) for this next project stage:** So that all partners are clear on what the next stage of project development entails, with the opportunity to still walk away if needed.

Cambridge City Council is in principle willing to fund at risk for Pre-Commercialisation Stage, acknowledging some roll forward of up to £100k Detailed Project Development (DPD) underspend. This financial commitment by the Council is contingent on Strategic Partners Letters of Support giving confidence that they are also fully vested in the next stage of project development. During Pre-Commercialisation Stage between March and October 2026, the Design, Build, Operations and Maintenance (DBOM) tender pack will be developed.

In autumn 2026, once the project's GHNF bid result is announced, Strategic Partners will be asked to approve the start of Commercialisation Stage, with additional gap funding likely to be required. During Commercialisation Stage the DBOM contractor will be procured; detailed technical designs will be developed; and the Joint Venture (JV) will be set-up, enabling the project costs to be finalised through the Final Business Case (FBC). Final Investment Decision (FID) is currently scheduled for summer 2028, when the Council will seek full recompense for its Pre-Commercialisation spend.

The OBC identifies the spending option which optimises value for money; confirms funding and affordability; and plans for successful delivery. This Minimum Viable Product (MVP), which supplies heat to all 20 Strategic Partners with anchor heat loads in the city centre. It's this OBC that is now subject to individual and collective governance approvals.

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## 2.2 Strategic Rationale and Case for Change

### 2.2.1 Strategic Context

The Cambridge City Centre Heat Network (CCCHN) is a city-scale, low-carbon infrastructure programme developed collaboratively by Cambridge City Council, the University of Cambridge, 17 city-centre Colleges, ARU and Cambridgeshire County Council. It responds directly to the decarbonisation challenge of historic, dense urban estates where building-level solutions are constrained by decarbonisation funding, space, heritage, grid capacity and disruption risks. This strong partnership is grounded by significant individual decarbonisation commitments, as evidenced by the targets, progress reporting, and individual project case studies presented in Appendix B.

Heating and hot water for UK buildings make up 40% of our energy consumption and 20% of our greenhouse gas emissions (Next Steps for UK Heat Policy – Committee of Climate Change 2016). The OBC demonstrates that coordinated, shared infrastructure offers a lower-risk, lower-cost and faster pathway to decarbonisation than fragmented, asset-by-asset approaches. As

government states in its recently produced Heat Zoning Consultation Response, heat networks are an essential part of our path towards lowering bills, decarbonising heat, enhancing energy security and achieving net zero by 2050.

As well as being cost effective, there are many other strategic benefits of connecting to CCCHN, which help justify collective and individual decisions to provide Letters of Support for the forthcoming GHNF bid:

1. Better carbon savings due to the pace and scale of the change
2. Control of future energy tariffs
3. Better reliability due to the thermal stores
4. The project is more deliverable in a space constrained and historic city centre than multiple on-site schemes
5. Access to decarbonisation grant funding from the Green Heat Network Fund (GHNF) that's otherwise unavailable
6. The City Council's facilitation role and strategic added value
7. The reduced hassle factor for decarbonisation delivery
8. Betterment opportunities that include an additional River Source Heat Pump Energy Centre and two additional potential thermal store locations. Much longer-term, opportunities could include heat network expansion connection to new data centre(s) and/or solar farm.
9. Heat network expansion opportunities across Cambridge highlighted by the Heat Zoning Study, with six times the heat demand Required to Connect through Heat Zoning.

In addition to standard Market Transformation social value commitments required by GHNF, the project aims to deliver strategic added value by capitalising upon both the strength of its strategic partnership and Cambridge's academic prowess. It is proposed to achieve this through:

1. **Heat Network Digital Twin:** seek external funding to Prove the Concept, procuring and delivering the digital twin as an integral part of the heat network's tender specification. This has the potential to strengthen the OBC across all CSFs (decarbonisation, cost, tariffs, reliability and social value); enhance the competitiveness of the Green Heat Network Fund bid, which is essential to project viability; and lay the groundwork for a city-scale Living Lab, aligned with Cambridge's growth and innovation agenda. This strategically aligns with the City Council's corporate objectives, University of Cambridge's research ambitions, and ARU's Sustainable Futures programme.
2. **Maximising Social Value:** shared commitment to social value and education, with potential avenues being investigated for reinvesting into expansion of the CCCHN, to help address fuel poverty and linked educational/training. Such a commitment would further strengthen our GHNF bid but is subject to Shareholder Committee review, noting that no up-front capital would be required by Strategic Partners. Reinvestment in the city could also deliver the social value requirements of the Council, who are project facilitators and contributing energy centre land. Considerations however need to be balanced against the need to ensure competitive energy tariffs for Strategic Partners.

Decarbonising heat in the UK is expensive compared to Business as Usual, due to the relatively high cost of electricity compared to gas. However, all Strategic Partners have committed to degasify, meaning the choice is whether:

1. **To develop a district heat network** with centralised heat pumps providing >85% of the annual heat demand, complemented by transitional gas for peak heating and Thermal Stores providing additional resilience and access cheaper time-of-use tariffs.

2. **Individual organisations or buildings pursue their own decarbonisation strategies**, primarily using individual heat pumps in combination with electric boilers at either a building and/or on-site level. Some buildings may not have the necessary space or be able to install heat pumps and will need to rely entirely on electric boilers, resulting in increased energy and connection costs.

Importantly, for any Institution that decides to stay with gas beyond MVP Phase 1 (2030-2033 Heat On) or MVP Phase 2 (2035 to 2037 Heat On), it is important to note that there is a **cost of doing nothing**. By not future installing the primary pipework to connect individual buildings and campuses to the renewable energy centres, the opportunity to connect to CCCHN may be lost for many years. The amount of cost and disruption incurred by installing 8km of primary network in Cambridge's historic centre is likely to be significant. The opportunity to add connections in the medium to long term would be difficult. The preferred approach is, where possible, to only dig once to minimise disruption to all stakeholders.

## 2.2.2 Policy and Regulatory Alignment

CCCHN is strongly aligned with:

- National net zero commitments and the Energy Act 2023
- Recently published national Warm Homes Plan- Growing the heat network market. One of their pillars is "*lowering the average cost of heat from heat networks, including through investment support, rebalanced fuel prices, and protecting against excess profits.*"
- Heat Zoning Consultation Response and Heat Network Zoning policy, which will mandate connections in designated zones from 2026
- Ofgem heat network regulation (from January 2026)
- Cambridge Local Plan Strategic District Heating Area (SDHA), which is already ahead of national policy
- Draft Climate Change Strategy for Cambridge and South Cambridgeshire

This alignment materially reduces long-term demand risk and improves investability. Importantly, Cambridge City Council's planning policy already anticipates mandatory connection for major developments, positioning CCCHN as the natural anchor for future city-wide expansion.

## 2.2.3 Strategic Objectives

The agreed Critical Success Factors prioritise:

- **Primary factors:** cost-competitive, reliable low-carbon heat; estate decarbonisation; and future expansion capability.
- **Secondary factors:** social value, minimise disruption, innovation and sustainability leadership.

The project has been designed to meet Strategic Partner decarbonisation targets, whilst preserving institutional autonomy and heritage assets.

## 2.2.4 Extensive Due Diligence

- **Technical Due Diligence:** Recognising the world leading academic excellence at the University of Cambridge, Colleges and ARU, as well as the influential role of College Fellows in decision making, an Expert Advisory Group (EAG) for CCCHN was established in Spring 2024. The EAG has provided technical due diligence during Detailed Project Development. All EAG recommendations have been accepted by the project's Steering Group.
  - **Strategic Engagement to derisk CCCHN:** The University of Cambridge convened a thematic meeting of its Special Interest Group on the Built Environment in September 2024 focussed on heat network development; Planning Performance Agreement (PPA) for CCCHN; and separate early strategic discussions with statutory and non-statutory consultees including the Environment Agency; Cambridgeshire County Council (Highways, Archaeology and Local Area Energy Plan); Historic England; Greater Cambridge Shared Planning; Greater Cambridge Partnership (GCP); the Cambridge Archaeological Unit; and UKPN.
  - **Financial Due Diligence:** Strategic engagement and funding from government and its Department of Energy Security and Net Zero (DESNZ) team; a Service Level Agreement with the National Wealth Fund (NWF), enabling its heat network team to be a critical friend for the CCCHN project; and regular meetings with the Green Heat Network's Fund Managers.
- 

## 2.3 Economic Case and Preferred Technical Solution

### 2.3.1 Options Appraisal and Value for Money

A comprehensive longlist and shortlist appraisal assessed available energy sources and heat network architecture (3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> generation heat networks) against economic, carbon, risk and deliverability criteria. The preferred option is a **heat-pump-led district heat network**, delivering circa **93% carbon reduction** versus Business as Usual, while remaining cost-competitive against individual building counterfactuals.

The Economic Case confirms:

- Lower whole-life cost of heat relative to decentralised solutions for the majority of connected buildings
- Reduced exposure to electricity grid reinforcement costs through diversity and centralised plant

### 2.3.2 Minimum Viable Product (MVP)

The MVP focuses on a city-centre network with sufficient anchor demand to ensure early financial viability. Of the 20 Strategic Partners interviewed at the end of 2025, 19 have confirmed in principle commitment to connect. Interest from additional stakeholders with city centre land holdings as well as future Zoning policy, mean that any loss of heat demand can be likely backfilled and expanded upon. Key features include:

- Low carbon heat generation (River Source Heat Pumps & Air Source Heat Pumps) to meet baseline heating demands
- Phased delivery to manage capital exposure and disruption
- N+1 resilience embedded in plant design, with pipe sizing future-proofed for expansion beyond MVP
- Thermal stores to enable the operator's access to cheaper time-of-use electricity tariffs, benefitting customer heat tariffs

The MVP is split across 2 Phases – Phase 1 (2030 to 2033) and Phase 2 (2035). This has been designed to enable both early adopters to connect by 2030, noting that this is still a challenging timeline, and those who've just invested in replacement gas boilers to connect 5 years later. The high temperature network enables all buildings to connect, regardless of the level of fabric energy efficiency improvements. CCCHN acts as a launchpad for wider Cambridge build-out, starting with 73GWH peak demand, 44MW of peak demand, 3 energy centres, 2 heat pump technologies and 8km of primary pipework.

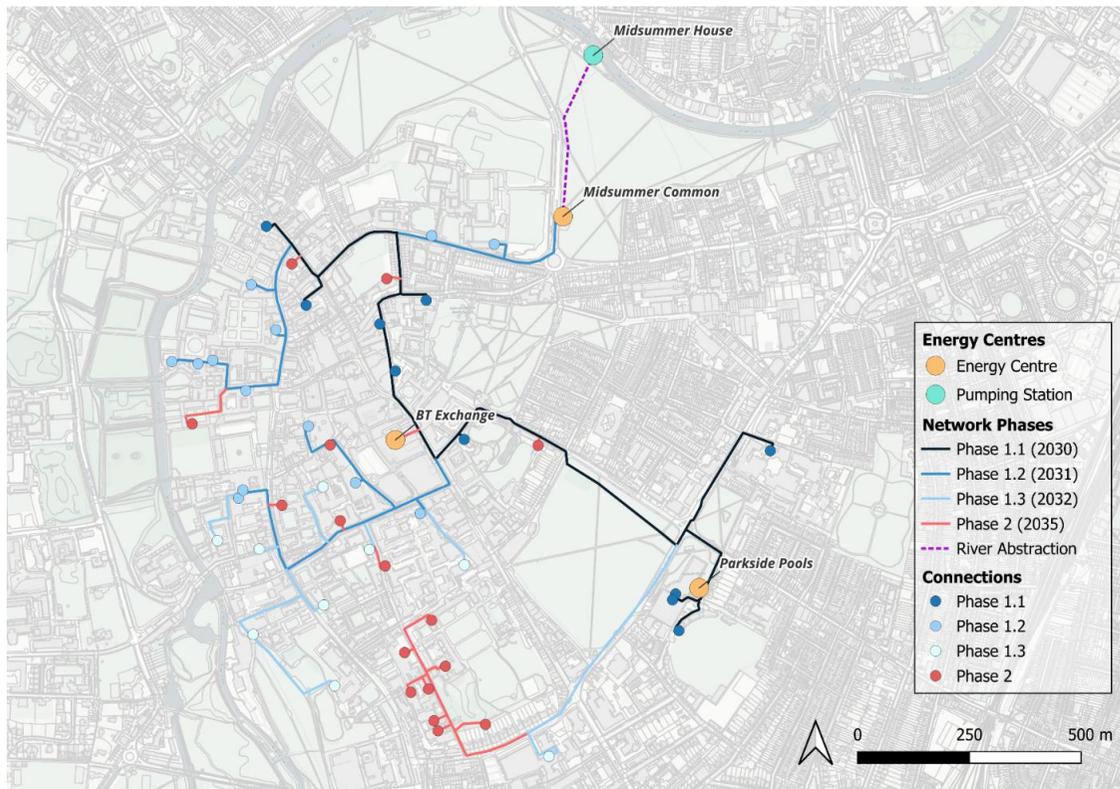


Figure 2—1 Preferred Option network layout & connections

The city-wide Heat Zoning Study identified a significant heat network expansion opportunity, with **over 300 GWh of future heat demand within immediate proximity of the city centre that's likely to be 'Required to Connect' by Heat Zoning. A total of over 450 GWh (6 times the MVP heat demand) is available in all surrounding zonal opportunities**, assuming a heat network proves to be the most cost-effective solution.

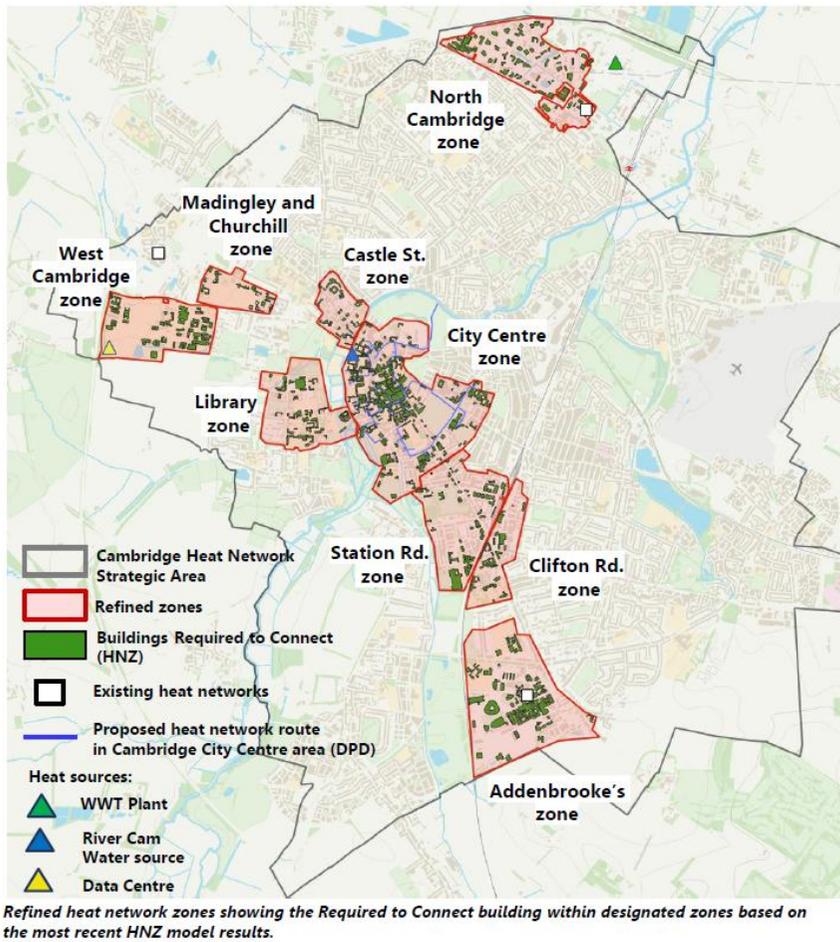


Figure 2—2 Heat Network Expansion Opportunity, Cambridge Heat Zoning Study

### 2.3.3 Timeline

Final Investment Decision is currently scheduled for summer 2028, with first Heat On by 2030.

### 2.3.4 Decarbonisation Delivery

The heat network connects circa 50% of total heat load in the city centre area in the MVP, thereby introducing significant carbon benefits for the city centre’s residents, institutions, businesses and visitors. The graph below shows how it is forecast to deliver 93% total carbon savings compared to gas (Business as Usual) over the 40-year Business Plan. It shows significant benefit realisation, with over 0.5 million tonnes of carbon saved in 40 years by the 20 Strategic Partners with anchor heat loads in Cambridge City Centre. This is a notable Cambridge response to the Climate Emergency, especially noting the ambition to expand the heat network across the city centre and wider Cambridge area.

Cambridgeshire County Council will soon produce its Local Area Energy Plan (LAEP) for Cambridgeshire. The heat network team has contributed evidence to this study and is working with the LEAP team to dovetail the conclusions with the CCCHN OBC. The LAEP will provide the evidence needed to demonstrate, quantify, and justify decarbonisation impacts in a way that is credible to funders, regulators, and decision-makers. Practically, it supports decarbonisation by establishing a defensible carbon baseline, quantified carbon savings for each potential pathway, and supporting investable Heat Zones. This avoids overstating decarbonisation benefits and improves credibility with scrutiny bodies.

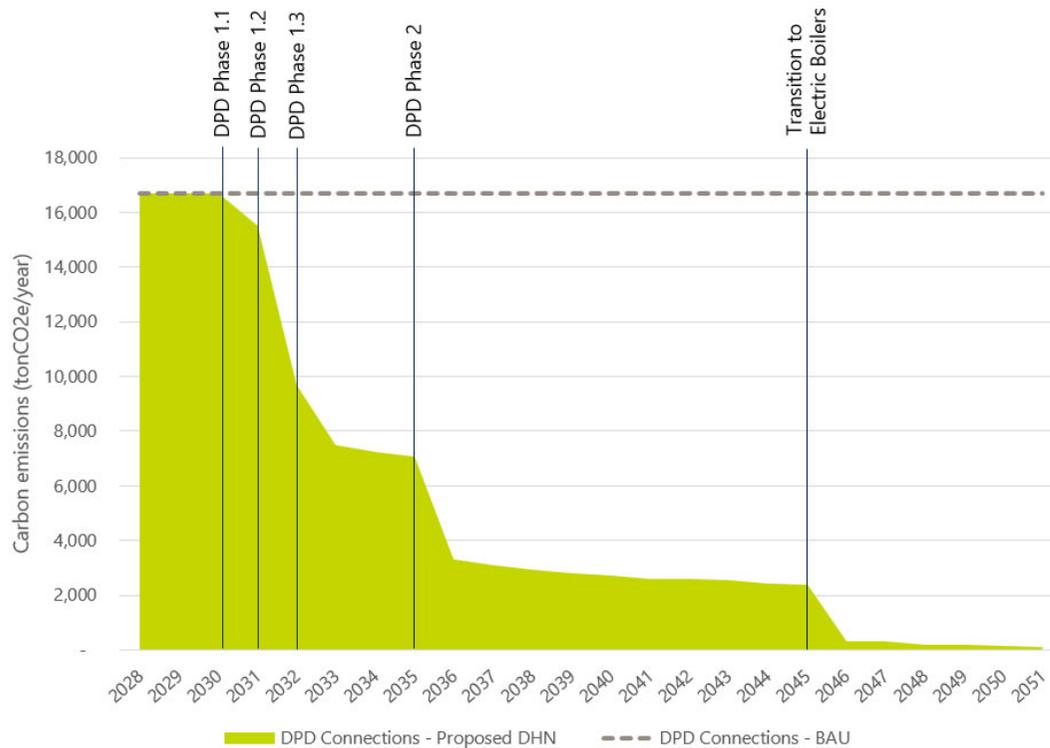


Figure 2—3 Carbon Savings Over 40-Year Business Plan

### 2.3.5 Lessons from Comparable Schemes

Evidence from UK schemes such as the Bristol Heat Network, Queen Elizabeth Olympic Park and Gateshead highlight consistent lessons applied in CCCHN:

- Early anchor demand commitment is critical to affordability
- Heat-pump-led baseload with transitional peak gas improves early economics
- Public sector leadership and facilitation enable strategic derisking

These lessons are embedded in the CCCHN preferred option.

---

## 2.4 Commercial Case and Investment Proposition

### 2.4.1 Preferred Delivery Model

Following structured commercial workshops, the agreed preferred model is a **51:49 co-investment Joint Venture**, with:

- 51% ownership by Cambridge City Council
- 49% ownership by investing Strategic Partners [REDACTED]

This structure balances control, risk and affordability; important to all Strategic Partners [REDACTED]. This financing structure enables access to public-sector financing (including National Wealth Fund) and to private financing via the Strategic Partners with financial capacity. Whilst a return is expected on all financing requirements, this approach provides Strategic Partner control of customer tariffs and collective Strategic Partner costs.

### 2.4.2 Rationale for Joint Venture

Compared to a Concession or fully public model, the JV:

- Retains strategic control with customers as owners, ensuring control of future Connection Charges, energy tariffs and focussed expansion
- Risk distribution between Developer, Operator, Customer and Owner. Development and operational risk is borne by the SPV. The debt risk is borne by the Council, as recipient of the NWF loan.
- Creates optionality for future refinancing or asset restructuring
- Can allow either existing investors or new investors to invest new capital to facilitate city-wide growth.

Private-sector delivery capability is retained through procurement of a **Design, Build, Operate and Maintain (DBOM)** contractor, mitigating capability risk while preserving customer ownership.

### 2.4.3 Customer and Investor Roles

Strategic Partners are clearly differentiated as:

- **Investing Strategic Partners:** equity participation, governance rights, exposure to returns and risks
- **Non-Investing Strategic Partners:** long-term heat supply contracts without equity exposure, where customers are asked to sign Heat Supply Agreements, with a likely term of at minimum 15 years, subject to negotiation. All MVP customers are Strategic Partners, materially reducing counterparty risk during early years.
- Flexibility exists for all Strategic Partners to review their equity positions as the project progresses.

### 2.4.4 Key Commercial Risks and Mitigations

- **Heat Demand risk:** is mitigated through MVP customer commitments, Heat Zoning, and identification of potential additional customers
- **Construction risk:** transferred via DBOM contract with performance regime. Soft market testing will be undertaken during Pre-Commercialisation to test and confirm the market position.
- **Regulatory risk:** mitigated through early compliance with Ofgem framework, which is borne by the JV owned Special Purpose Vehicle
- **Governance complexity:** managed through streamlined voting blocks and reserved matters

Experience from multi-party JVs (e.g. Newcastle Helix) has informed governance simplification to control transaction and operating costs.

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## 2.5 Financial Case and Costs

Please note, version2 of the Financial Case, has been published. Subsequent iterations are to follow during Pre-Commercialisation. These will further verify the forecast cost implications. The current version presents robust and adequate detail for Strategic Partner review. No Financial Investment Decision (FID) is required based on the OBC. This is determined at Full Business Case (FBC) at the end of Commercialisation Stage, which is scheduled for summer 2028.

The Financial Case has been informed by Strategic Partner engagement at DPD leading to the following outcomes:

- Feedback from customers and potential equity investors regarding 'must haves' and 'nice to haves', with the aim of presenting a viable Business Case that works for customers, equity investors and the developer (once appointed).
- The financial model presents true equity investment market position and investor terms, with no hidden costs sitting on Strategic Partner books, as the starting point for further derisking and optimisation. Equity investors can't subsidise the cost of heat, given the inherent risks associated with developing and delivering a large infrastructure project. The OBC also includes the extra cost of owning and operating a customer owned energy company. The financial model has a **target equity IRR of [REDACTED] over 40 years**. Further validation and derisking of costs planned for Pre-Commercialisation. The second planned injection of capital at Year 18 will have its own Business Case.

- An equity investor position that is not solely a financial investment but also provides long-term strategic derisking. This is achieved by Strategic Partners retaining control of both customer energy prices; the pathway to full decarbonisation (using electric boilers for top up heat); and future heat network expansion.

The latest financial modelling forecasts that in the most spatially and historically challenging part of the city:

- **A total Capital Expenditure of [REDACTED] million excluding VAT (£119m initial spend across first 5-years of project, followed by further £26m at Year 18 for full electrification):** in nominal price base, noting that construction isn't forecast to start until at least 2029. This assumes no fabric improvements to individual buildings and campuses; Strategic Partners individually funding any required on-site secondary upgrades; and replacement expenditure for gas boiler replacement. [REDACTED]
- **A forecast equity IRR of [REDACTED] at Year 40:** to ensure the returns reflect the risks of the project, [REDACTED]
- **Updated forecast customer costs:** Compared to the blended counterfactual (the total costs of alternative low-carbon heating solutions), the Preferred Funding Option, with an updated version 2 baseline position against the blended counterfactual is forecast to deliver:
  - **[REDACTED] reduction in Levelised Heat Price.** The Levelised Heat Price is the present value of revenues (variable tariff, fixed tariff and Connection Charges) divided by the present value of MWh (heat demand). It is the average lifetime cost to customers for heat, expressed per unit of heat delivered (p/kWh).
  - **[REDACTED] reduction in forecast customer Connection Charges**
  - **[REDACTED] reduction in forecast Variable Charges** at a network level, due to the use of transitional gas boilers for peak heating for a maximum of 15 years (one gas boiler life cycle), as compared to the original ambition of using electric boilers for peak heat.
  - **[REDACTED] increase in forecast Fixed Charge:** Due to the Management Costs of operating a customer owned energy company. This includes private-sector expertise to manage the Joint Venture; the Design, Build, Operations and Maintenance contract; and associated risks and opportunities associated with a kickstart heat network in the centre of Cambridge.

**Individual updated forecast customer costs will be shared with individual Strategic Partners in early February 2026, noting that actual customer and equity investment costs won't be fixed and finalised until Final Investment Decision, which is scheduled for summer 2028.**

In Year 18 of the project, the gas boilers will have reached the end of their useable life and will need to be replaced. As the aim is to further decarbonise, the project, as modelled, requires additional investment to fund the costs of replacing gas with electric boilers and will likely need to pay for electrical grid upgrades (the costs of which can only be estimated at this stage). Prospective investors advise that this investment carries less risk than the initial investment, so the return on investment of the later equity injection can be slightly reduced with forecast tariffs also reduced beyond Year 18. This is all based on the MVP, without any prospective expansion. This reduction in tariffs is factored into the 40-year Levelised Heat Price and the overall 12% Equity IRR.

Cost overruns are a particular concern for potential equity investors. In response, a **worst-case scenario of 30% cost overrun has been modelled:** noting that a 15% overall contingency and additional project specific risk factors are already included in the techno-economic model. Even in this scenario, the Levelised Heat Price is still competitive against the blended counterfactual. Further due diligence of real-world construction costs is underway. The Commercialisation Stage will also be used to competitively test these assumptions through procurement, which may identify efficiencies to further reduce the Levelised Heat Price.

**Assumed 50/50 Pain and Gain split between equity investors and customers on cost overruns:** Further analysis of the assumed 50/50 Pain and Gain split between equity investors and customers on cost overruns is required. This will be negotiated during Pre-Commercialisation and Commercialisation Stages, with the aim of continuing to ensure cost competitiveness against blended and local counterfactuals, including in the event of a 30% 'worst-case' cost overrun scenario. This may be achieved if customers agree to take up to 50% of the cost overrun risk with equity investors. Upside scenarios with potential cost savings will also be considered as part of this discussion. There may also be the opportunity to push some cost overrun risk onto the DBOM contractor. The aim is to avoid the scenarios of:

- High Connection Charges, which albeit being fixed and risk free, may be unaffordable for some Strategic Partners.
- Significantly increased tariffs - which loads risk onto heat network financial viability and impacts long term consumer cash flows.

The following potential upsides will be investigated and quantified using Sensitivity Analysis during Pre-Commercialisation:

- **Incorporation structures:** Through engagement with specialist tax advice, the pros and cons of different incorporation structures for the energy company. Currently assumed to be a Company limited by shares, the energy company could also be incorporated in a different legal form
- **Subsidy Control:** Treasury Management advice regarding the On-Lending Margin, which is the premium covering for the Council for taking the project's debt risk with NWF.

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## 2.6 Management Case and Delivery Readiness

### 2.6.1 Delivery Track Record

The project has completed two years of Detailed Project Development with:

- 19 of 20 Strategic Partners expressing in-principle commitment to connect
- 9 Strategic Partners considering equity participation
- Strong senior officer engagement and transparent governance

This represents a materially de-risked position relative to typical UK heat network projects at OBC stage.

### 2.6.2 Governance Arrangements

Governance evolves from development to operation:

- **Pre-Commercialisation/Commercialisation:**
  - Cambridge City Council as lead partner
  - Shareholder Committee replacing Steering Group
  - Core Group retained for operational oversight
- **From Final Investment Decision (FID) to Operations:**

- HeatCo Board established 6–12 months pre-FID
- Clear separation between shareholder oversight and executive delivery

### 2.6.3 Resourcing and Capability

The Management Case confirms adequate resourcing through to MVP “Heat On”, including:

- Dedicated HeatCo Director with appropriate heat network experience
- Contract and stakeholder management capacity
- Owner’s Engineer and Employer’s Agent support

This addresses a common concern about public-sector-led energy companies needing adequately experienced executive and client-side management.

The Pre-Commercialisation and Commercialisation workstreams are:

1. Programme Management
2. Strategic Partner Governance & Quality Assurance
3. Stakeholder Engagement & Communications
4. Technical derisking & betterment
5. Procurement, including Procurement Strategy, tender pack preparation and procurement
6. Commercial derisking & betterment
7. Heat Network Digital Twin, Proof of Concept (external funding tbc)

### 2.6.4 Strategic Risks and Interdependencies

A detailed Risk Register supports the project and is regularly updated. As of December 2025, the top 5 strategic risks were identified as:

1. Insufficient heat demand, due to limited Letters of Support from individual Strategic Partners in Q1 and Q2 2026
2. Costly electrical power upgrades
3. National influences on Delivery Model consultations, including Devolution and the potential role of the City Council, as both majority shareholder and Zone Coordination Body
4. Unsuccessful GHNf funding bid in Spring 2026
5. Reputational and economic damage from heat network construction and disruption

Risk mitigation measures have been developed and are described in detail the Strategic Case.

Heat network interdependencies include Local government reorganisation; Cambridge City Council: Civic Quarter Redevelopment; University of Cambridge: Reshaping our Estate; Energy retrofit of Strategic Partner buildings; Heat Network Zoning; Local Plan Consultation; and UKPN Grid Reinforcements. The associated risk and benefits are described in Table 3—11.

### 2.6.5 Programme and Next Decisions

Key forthcoming decisions for Strategic Partners include:

- Formal in-principle confirmation of connection and/or equity position
- Participation in Pre-Commercialisation Stage, with development of the scope of works and tender pack to procure an experienced Design, Build, Operations and Maintenance contractor
- Final Investment Decision (target: summer 2028), subject to Final Business Case

Clear fallback scenarios are defined should project closure be required prior to FID, limiting downside exposure.

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## 2.7 Strategic Partner Takeaways

- CCCHN is a **policy-aligned, investable, customer-owned decarbonisation solution** for Cambridge city centre
- The preferred JV structure provides customer control of Connection Charges, future energy tariffs and targeted expansion
- Strategic Partners retain control while sharing out delivery risk
- Early participation secures long-term heat price stability and strategic influence over expansion

The Outline Business Case demonstrates that CCCHN is **viable, value for money and deliverable**, with risks understood and actively managed

## 3 Strategic Case

### 3.1 Strategic Context

The Strategic Case demonstrates how the spending proposal fits with national, regional and local policies, strategies and plans. It provides the strategic justification for the Cambridge City Centre Heat Network project. It demonstrates that the infrastructure investment delivers all primary and secondary Critical Success Factors agreed with 21 Strategic Partners. It is predicated upon a robust evidence-based case for change.

**Our Vision** for the Cambridge City-Centre Heat Network is to set a new standard for sustainable urban living. It is about making Cambridge a model city for the future, where history is preserved, the environment is protected, and new technologies help the city thrive.

Cambridge City Council, the University of Cambridge, 17 city centre University Colleges, Cambridgeshire County Council and Anglia Ruskin University (ARU) have worked together to develop the Outline Business Case for the Cambridge City-Centre Heat Network. It's a strategic Decarbonisation Partnership.

We aim to remove existing and polluting gas boilers from individual buildings, replacing them with a renewable heat network. Our ambition is to connect individual buildings from both the City Council, University of Cambridge, College and ARU estates by 2030.



The Outline Business Case (OBC) for the Cambridge City Centre Heat Network aims to answer three fundamental questions:

1. **Is the Cambridge City Centre Heat Network viable?** Does it deliver the project's Critical Success Factors? Is it value for money?
2. **Is there enough evidence for Strategic Partners in the Minimum Viable Product (MVP) to provide a strong intention to connect and commit to Commercialisation Stage?**
3. **For Strategic Partners considering investing in the project, what is the associated risk, reward and control?**

The OBC identifies the spending option which optimises value for money; confirms funding and affordability; and plans for successful delivery.

Subject to governance approvals, Commercialisation Stage will follow to procure the preferred delivery option. This culminates in the Final Business Case (FBC), with final detailed costs.

Please see Figure 3—1 for a summary of the Strategic Partner, Customer and Developer Journeys.

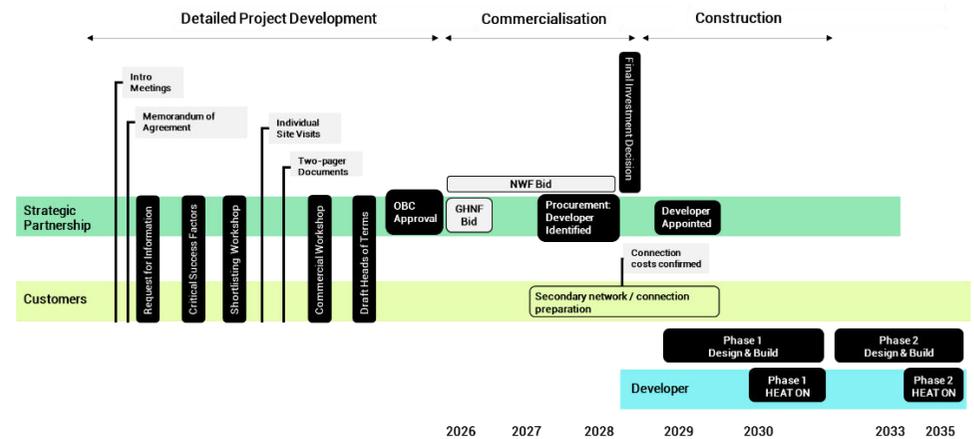


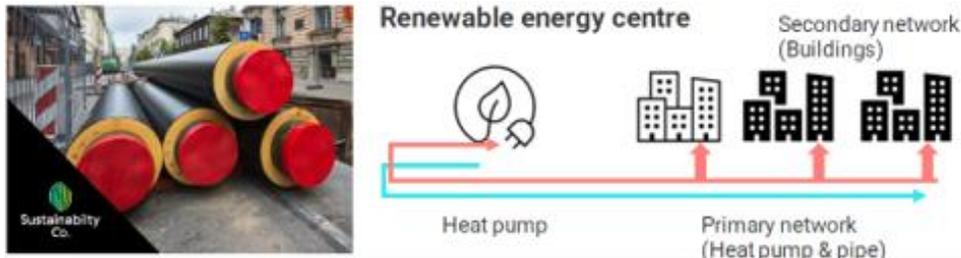
Figure 3—1 Strategic Partner, Customer & Developer Journeys

## 3.2 Background

### 3.2.1 What is a heat network?

A heat network delivers space heating, hot water and sometimes cooling to multiple buildings via an underground network of water pipes. There are two pipes – a flow and return.

Heat networks are Business as Usual for many continental European cities. The C40 Good Practice states that 98% of Copenhagen’s heating is supplied by modern district heat networks. One third of Berlin’s residential buildings are connected to a heat network (Eon 2024). In the Netherlands, the share of homes heated via district heating (or “block heating”) was about 6.7% in 2021 (Energie Nederland 2021). In the Arenpoort area of Amsterdam, a digital twin enables integration of energy systems including heat pumps, buildings, solar and electric vehicles. This supports local flexibility, demand shifting, and utilising thermal storage / on-site flexibility, unlocking a new generation of city-wide systems (Energie Lab Zuidoost 2025).



Heat networks use mature technology, water pipes in the ground. They are also technology agnostic, so able to use different energy generation technologies. They can capture waste heat (from Energy from Waste plants, data centres and sewage treatment works) and environmental heat (air, water and ground) using heat pumps. Just a decade ago, gas Combined Heat Power (CHP) was the go-to technology. New heat networks now predominantly use environmental heat as renewable energy.

There are lots of operational UK heat networks (typically CHP led) that are decarbonising:  
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1. The heat network at Queen Elizabeth Olympic Park uses gas fired CHP but is now almost 15 years old and is actively developing its transition strategy to low carbon, which includes chiller heat recovery (operational) and may include further future decarbonisation through waste heat, river source and air source technologies.
2. The Citigen Heat Network in the City of London is one of the UK’s largest urban-scale district heating & cooling networks, using gas CHP, gas boilers and deep borehole open loop Ground Source Heat Pumps (GSHPs)
3. Bunhill 2 in Islington uses waste heat from the London underground. It connects into Bunhill 1, which uses gas CHP.

In addition, there is a large pipeline of new UK heat networks under development, which are typically low carbon:

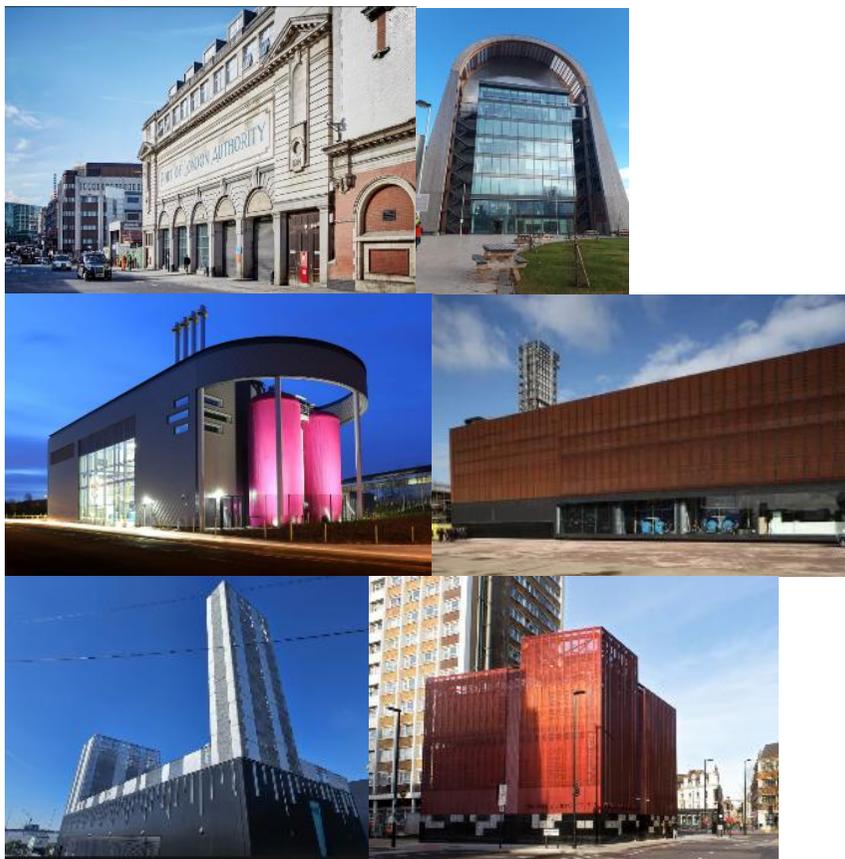
1. The Notting Dale Heat Network in North Kensington, with 2 x Air Source Heat Pumps (ASHPs) and a cascade system to a closed loop Water Source Heat Pump. This heat network is under construction
2. Brent Cross Town development will use ASHPs. It’s at RIBA Stage 3 design and pre-construction
3. The Kingston heat network in Richmond will use Water Source Heat Pumps (WSHPs) to access waste heat from a large sewage treatment works (pre-construction)
4. The Oxford Heat Network is being developed using heat pump technologies for the baseload heat demand, with gas for peak heating
5. Bristol Heat Network uses multiple energy sources, including a 3MW River Source Heat Pump located in Castle Park.

Several UK heat network schemes have won national awards, including energetik (Energy from Waste in North London); Leeds PIPES (Energy from Waste); and Gateshead Heat Network (Phase 2 includes both a large WSHP and mine-water heat recovery).

Heat networks are future-proofed systems. Once installed, additional energy generation technologies can be added or changed. There’s no building level disruption as energy

generation technologies evolve. Importantly, heat networks have the flexibility to expand, with the opportunity to connect new buildings and interconnect with other heat networks.

More detailed case studies are provided in Appendix T, providing three UK case studies on both Enviroenergy in Nottingham, Worthing and Sheffield heat networks, including lessons learned and how they've been applied to the CCCHN Outline Business Case.



**Figure 3—2 Citigen, Leeds PIPES, Gateshead, Queen Elizabeth Olympic Park, Bunhill 2, energetik & Leeds PIPES energy centres (clockwise)**

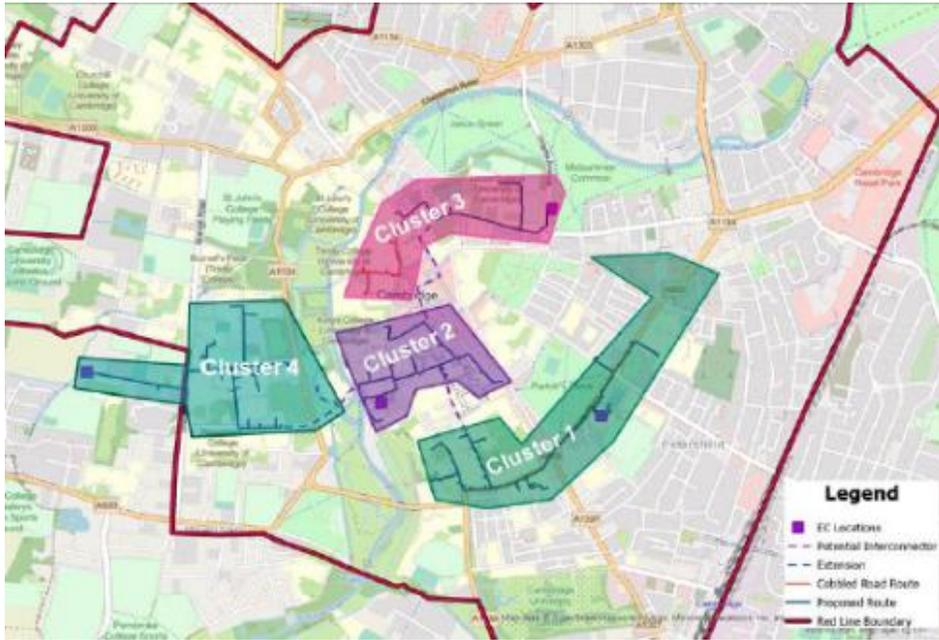
### 3.2.2 Project History

In December 2021, Cambridge City Council appointed 'Sustainability Co' to bid for government funding from the Heat Network Delivery Unit (HNDU), to help develop a city-scale heat network in Cambridge city centre. Stakeholder engagement secured Letters of Support from the Leader and Chief Executive of Cambridge City Council; the University of Cambridge's Vice-Chancellor; and the Bursars of seventeen University Colleges. The bid was successful, with £98k grant awarded by government in Spring 2022.

#### 3.2.2.1 Heat Mapping and Masterplanning, and Feasibility

As Heat Network Programme Managers, Sustainability Co procured AECOM engineering consultants, leading work with partners to produce both a Heat Mapping and Masterplanning (HMMP) Study and a Feasibility Study for the Cambridge City Centre Heat Network (CCCHN). Officers from both Cambridge City Council, the University of Cambridge and Sustainability Co formed the Core Group. ARU's Head of Sustainability was also actively engaged.

The Heat Mapping and Masterplanning (HMMP) Study identified the opportunity to establish a low/zero carbon heat network within Cambridge city centre, with the potential to expand to create a city-scale heat network. Heat demands, renewable heat sources and potential pipe routes were identified and mapped. High-level techno-economic modelling identified four potential heat network clusters, with the opportunity for full build-out of all 4 clusters as a city centre heat network. The study reported in May 2023.



**Figure 3—3 Heat Network Clusters from HMMP Study**

Subsequently, a Heat Network Feasibility Study was undertaken, which reported in September 2023. It highlighted that Cambridge City Council, University of Cambridge, ARU and 17 city-centre based University Colleges are all seeking to decarbonise their Estates, all recognising the urgency of addressing climate change, with several Strategic Partners setting stretching decarbonisation targets.

Anticipating the continued decarbonisation of the UK's electrical grid, it is likely that heat pumps offer the fastest path to achieving low-carbon heating. The city centre area that was covered by this study evaluated two primary options for enabling the decarbonisation of heating:

1. **Develop a district heat network** with centralised heat pumps providing around 80% of the annual heat demand, complemented by transitional gas for peak heating and Thermal Stores providing additional resilience and access to cheaper time-of-use tariffs.

2. **Individual organisations or buildings pursue their own decarbonisation strategies**, primarily using individual heat pumps in combination with electric boilers at either a building and/or on-site level. Some buildings may not have the necessary space or be able to install heat pumps and will need to rely entirely on electric boilers, resulting in increased energy and connection costs.

The Feasibility Study reviewed these two options, demonstrating that a heat pump led district heat network in Cambridge city centre could be technically and financially viable, subject to Detailed Project Development (DPD). It included a RIBA Stage 2 Reference Design for both the energy centres, primary pipe route and bulk heat supply to each connection point via plate heat exchangers; techno-economic modelling; and financial modelling. CCCHN could help facilitate the transition from the city's current use of natural gas fuelled boilers to a low/zero carbon alternative that is cost competitive with the decarbonisation of individual buildings. This could benefit Strategic Partners and other potential heat loads.

AECOM's Preferred Option Summary from the Feasibility Study is shown in Table 3—1 for Full Build Out of the 3 city-centre clusters, with an ASHP based solution and electric top up boilers. It assumed 93 potential connections for bulk heat supply and a heat demand of 105GWh, with a heat peak demand of 42.5MW. The IRR is pre-finance but much higher than DPD; this is primarily because the total forecast CapEx was estimated to be £81 million, whereas design development in the DPD stage has seen this increase due to new energy centre buildings (rather than use of existing building rooftops); more conservative pipework costs (to sufficiently account for archaeology and other risks); and inclusion of river source offtake (which has higher development costs but lower operational costs).

**Table 3—1 AECOM's Preferred Option, Feasibility Study, September 2023**

| Scenario                      | EC Location  | CAPEX        | IRR (40 years) | Carbon Savings vs Counterfactual (40 years) (tCO <sub>2</sub> ) | Carbon Savings vs Gas Boiler (40 years) (tCO <sub>2</sub> ) | LZC Technology and Capacity | Length of pipework |
|-------------------------------|--|--------------|----------------|---|---|-----------------------------|--------------------|
| Full Build ASHP excl. Library | Midsummer Common, Mill Lane / New Museums, Parkside Pool | £80.9million | 5.49%          | 5,500   | 595,000   | 13MW ASHP                   | 11.9km             |

The heat network team opened a request for energy data and Expressions of Interest in CCCHN, which Strategic Partners responded positively to.

AECOM’s Feasibility Study recommended that DPD:

- 1) Is based on a Study Area that is purely focussed on the city-centre, excluding the Library Cluster due to a lower heat density and the large amount of capital investment likely to be required to take heat network pipes across the River Cam.
- 2) Uses ASHP as the primary low carbon technology.
- 3) Further investigates the use of GHSPs, to determine practical deliverability and how they could further potentially optimise an ASHP led Preferred Technical Option.

AECOM also produced a Future Proofing Guidance Note for building owners across Cambridge, to help them plan for future heat network connection. This document has now been updated by Buro Happold and is included as Appendix H.

In July 2023, the University of Cambridge appointed Sustainability Co to more comprehensively engage University Colleges ahead of Detailed Project Development (DPD), recognising their importance to DPD as both large potential anchor heat loads and long-term Institutions with decarbonisation ambitions and large freeholdings across Cambridge. Sustainability Co’s key findings from this College stakeholder engagement in summer 2023 are shown in Figure 3—4.

In December 2023 this engagement was extended to further derisk the project through individual meetings with senior officers at each College. Letters of support were provided by the College Bursars, Cambridge City Council, the University of Cambridge and ARU to support a second grant application. The resultant HNDU bid was successful, with £272,500 grant awarded for DPD. This was combined with £720k match-funding from the fourteen Strategic Partners listed in Table 3—2.

Because Strategic Partners own so much of the city centre, this relatively small group of stakeholders’ control the anchor heat loads needed to create a Minimum Viable Product. This makes the proposition easier to deliver.

**Figure 3—4 Summary of College Engagement, 2023**

Many Colleges have already created long-term decarbonisation targets, in line with UK Carbon budgets. Other Colleges are operating on a project-by-project basis, as opportunities arise.

Colleges unanimously noted the challenges of a ‘fabric first’ approach for buildings that are up to 800 years old. These challenges include technical, financial, disruption, lack of space, conservation and planning policy.

Several Colleges have started to decarbonise heating and hot water within their estates. At this stage, most have delivered decarbonisation projects for specific buildings, rather than an estate-wide heat decarbonisation project. The city-centre heat network project is an important proposition, providing an alternative option to on-site heat networks and building level heat solutions. It brings economies of scale and reduced on-site complexities.

| College Decarbonisation Plans |   |
|-------------------------------|---|
| 6                             | Published decarbonisations plans                                |
| 6                             | Due to release decarbonisation plans                            |
| 5                             | Project-based action plans                                      |
| Decarbonisation of heating    |   |
| 11                            | Colleges with ASHP installed                                    |
| 4                             | Colleges with GSHP installed                                    |
| 0                             | Colleges with WSHP installed<br>(5 potential projects emerging) |
| 2                             | Completed UKPN upgrades   |

**Table 3—2 DPD Funding Contributions**

| <b>Strategic Partner</b>  | <b>DPD funding contribution</b> |
|---|---------------------------------|
| Cambridge City Council  | £180,000                        |
| ARU   | £30,000                         |
| Heat Network Delivery Unit (HNDU)   | £272,500                        |
| University of Cambridge - <i>the overarching body responsible for academic standards, degree awards, central policy, research strategy, major infrastructure, compliance, and external representation. It manages faculties, departments, laboratories and central services.</i>  | £180,000                        |
| Contributing Colleges - Christs, Clare, Corpus Christi, Jesus, King's, Peterhouse, Queens', Trinity, Trinity Hall and St John's.<br><br><i>Colleges are legally independent, self-governing institutions responsible for admissions, pastoral support, accommodation, small-group teaching &amp; the local student community.</i> | £330,000                        |
|   | <b>TOTAL<br/>£992,500</b>       |

### 3.2.2.2 Detailed Project Development (DPD)

In October 2023, Sustainability Co was reappointed through open procurement as Heat Network Programme Managers for DPD Stage, with Cambridge City Council as the lead client. An open procurement exercise was also undertaken to appoint specialist heat network consultants - Buro Happold (engineers), Amberside Advisors (commercial and financial) and Sharpe Pritchard (legal advisors).

Formal governance arrangements were developed to manage engagement and decision making between 21 Strategic Partners, through the creation of a Core Group for operational decision making and a Steering Group for strategic decision making. Many thanks to the large number of officers who have given significant time to constructively challenge and support Detailed Project Development. These governance arrangements are summarised in Figure 3—5.

The project's updated Steering Group first met in May 2024, at the start of DPD. It includes senior representatives from Cambridge City Council, University of Cambridge, ARU and the University Colleges. During DPD the Steering Group has reviewed and approved the Core Group's recommendations in Appendix D, providing the strategic direction and decision making needed to enable the heat network team to deliver this Outline Business Case (OBC).

All 21 Strategic Partners signed a Memorandum of Agreement to confirm their commitment to collectively proceed with DPD, which was approved by Steering Group in January 2025. This included the seven 'Participating Colleges' that have supported DPD as potential heat network customers, albeit without DPD funding contributions. They are Downing, Emmanuel, Gonville & Caius, Hughes Hall, Pembroke, Sidney Sussex and St Catharine's Colleges.

Cambridgeshire County Council is also a Strategic Partner. Although it has no anchor heat loads within the city centre, it's archaeology, highways and strategic energy functions have an important role to play. Early strategic engagement with these teams has helped derisk the project. Most notably we can ensure strategic alignment with the Local Area Energy Plan (LAEP). The County Council also has first-hand experience of delivering the Swaffham Prior Heat Network, which is included as a case study in Appendix B.

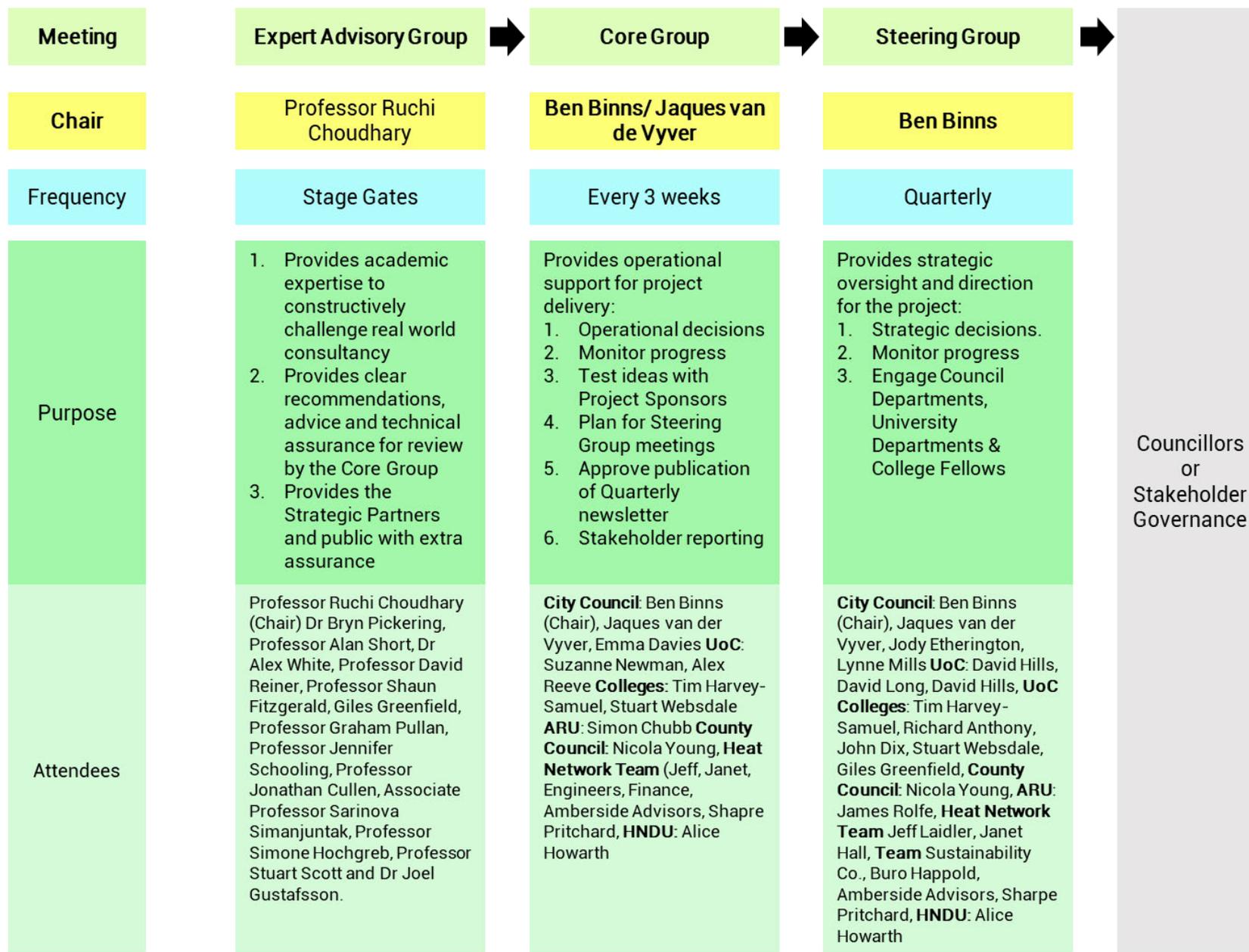


Figure 3—5 Governance Arrangements

The Decision Pathway is summarised below.

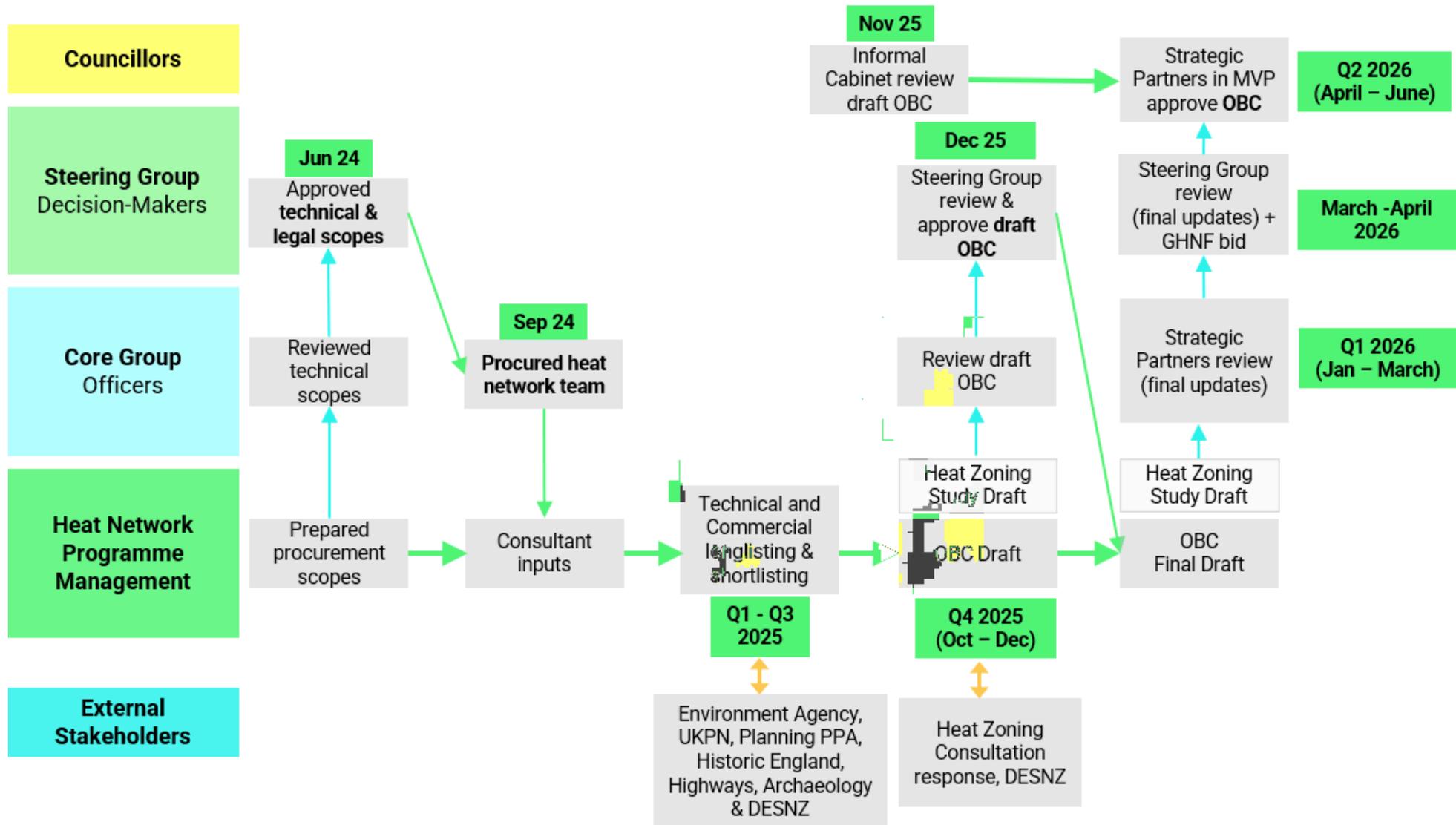


Figure 3—6 Decision Pathway

### 3.2.3 Cambridge City Council's Facilitation Role

Cambridge City Council has undertaken a proactive facilitation role, working closely with Strategic Partners to:

Chair the Core and Steering Groups, working closely with Strategic Partners

Procure and manage the heat network team

Use its local policy levers to enable heat networks. Local Planning Policy requires heat network connections, with the Council leading the way in UK heat network policy with its 'Strategic District Heating Area.' This fits well with national Heat Zoning policy, which also mandates connections

Complete Detailed Project Development

Enable successful strategic partnership with both DESNZ and the National Wealth Fund

Derisk the project through early engagement with future statutory consultees and strategic bodies, including Greater Cambridge Partnership; the Environment Agency, Historic England and UKPN

Facilitated strategic links with Cambridgeshire County Council to access specialist archaeological, highways and strategic energy masterplanning expertise. As a result, the Cambridge City Centre Heat Network project is being strategically aligned with the recently completed Local Area Energy Plan (LAEP) and its conclusions

Complete a Heat Zoning Study for Cambridge.

The Cambridge City Centre Heat Network project also aligns with Cambridge City Council's Strategic Objectives, Local Planning Policy, and its Climate Change Policy (with potential for Biodiversity Net Gain). The project would make the largest contribution to the Council's Climate Change Plan.

Cambridge Local Planning Policy on heat networks is ahead of national Heat Zoning Regulations, with large heat loads in the city's Strategic District Heating Area (SDHA) required to connect. Policy 28 of the adopted policy framework on Carbon Reduction, Community Energy Networks, Sustainable Design and Construction:

Requires major developments to consider communal or district heating where feasible

Encourages site-wide low-carbon energy solutions

Supported by the Sustainable Design and Construction Supplementary Planning Document (Greater Cambridge Shared Planning 2020), which sets technical expectations for heat network readiness (e.g. heat interface units, flow/return temperatures, and carbon reporting).

Policy 29 Renewable and Low Carbon Energy Generation (Greater Cambridge Shared Planning 2018), supports local energy schemes, including district heating, subject to viability and environmental impacts.

The Strategic District Heating Area (SDHA) shown in Figure 3—7 covers the city centre, with a current Local Plan consultation proposal to extend it to cover the majority of Cambridge (see Figure 8). Within the SDHA, connection to the heat network is a requirement for new developments and major refurbishments, unless technically or financially unviable. The SDHA aims to decarbonise heating for historic and public buildings that cannot readily achieve low-carbon heat on-site. Cambridge City Centre Heat Network Guidance (Cambridge City Council 2023) advises developers to "future-proof" buildings within and near the SDHA to enable later connection.

The list of Council decisions over the project life are shown in Table 3—3.

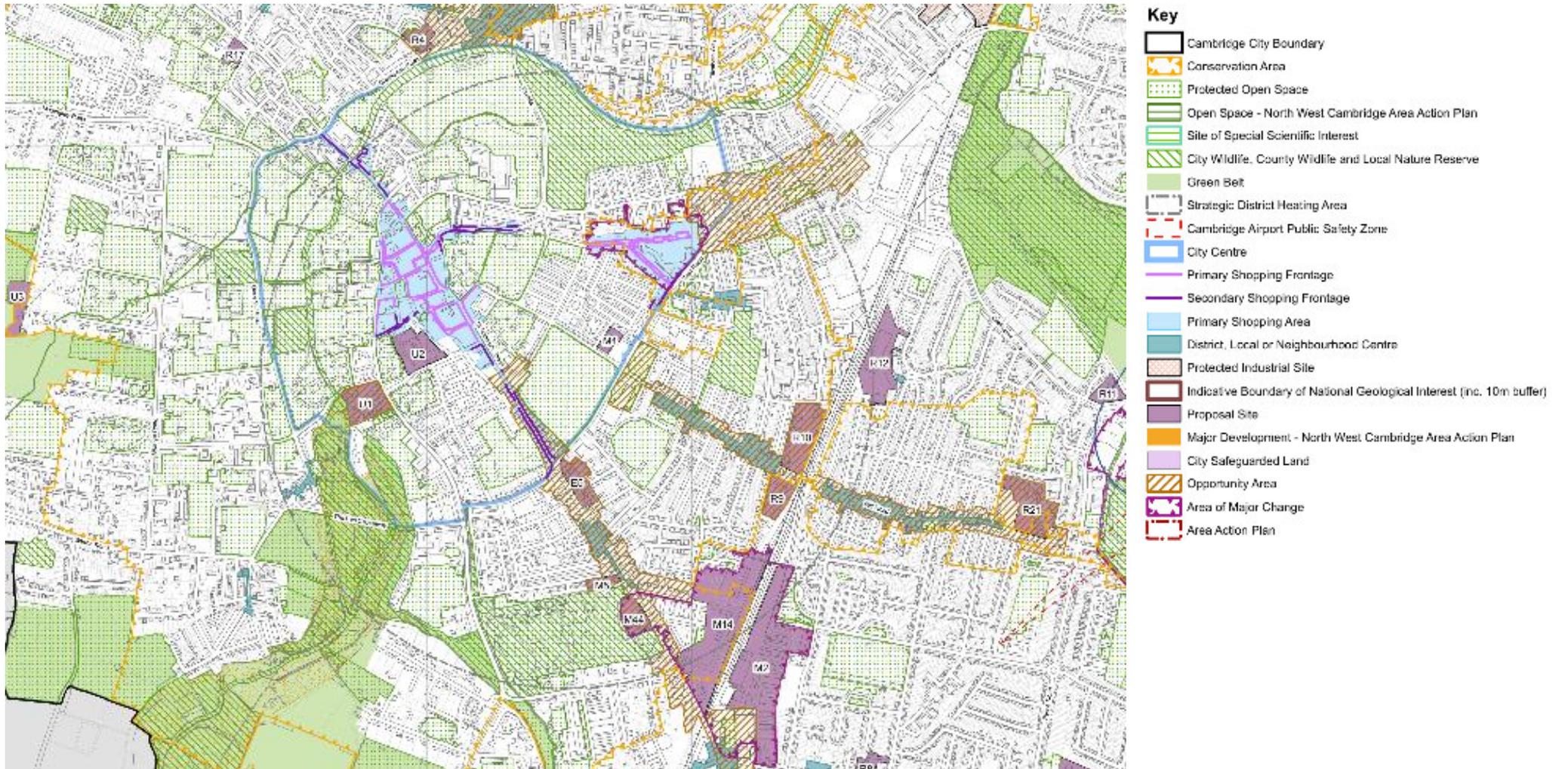


Figure 3—7 Current Strategic District Heat Area (Local Plan)

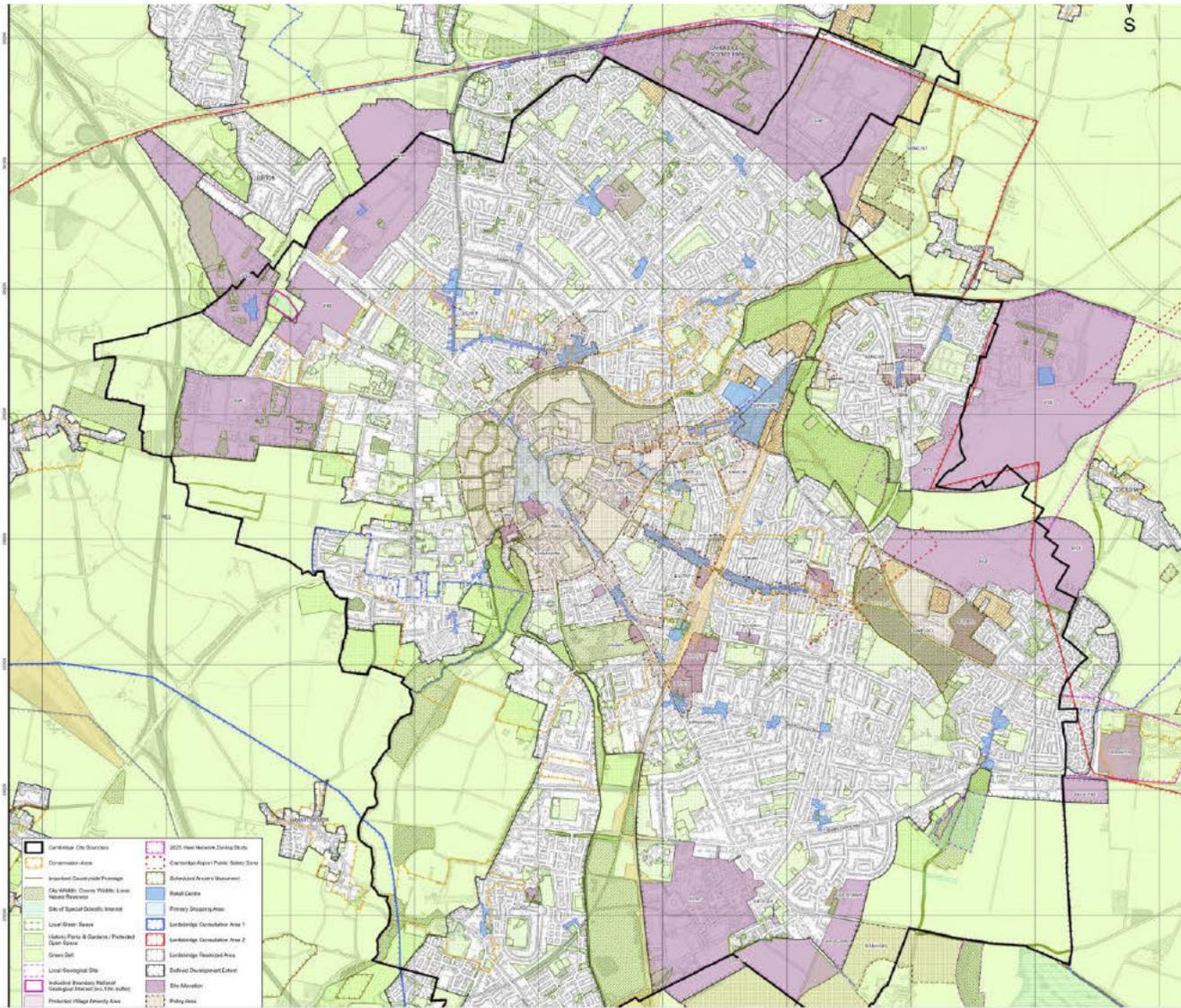


Figure 3—8 Local Plan Consultation with much larger Strategic District Heat Area (in grey)

The Cambridge City Conservation Area is shown for context in Figure 3—9, noting that it covers the entire city-centre.

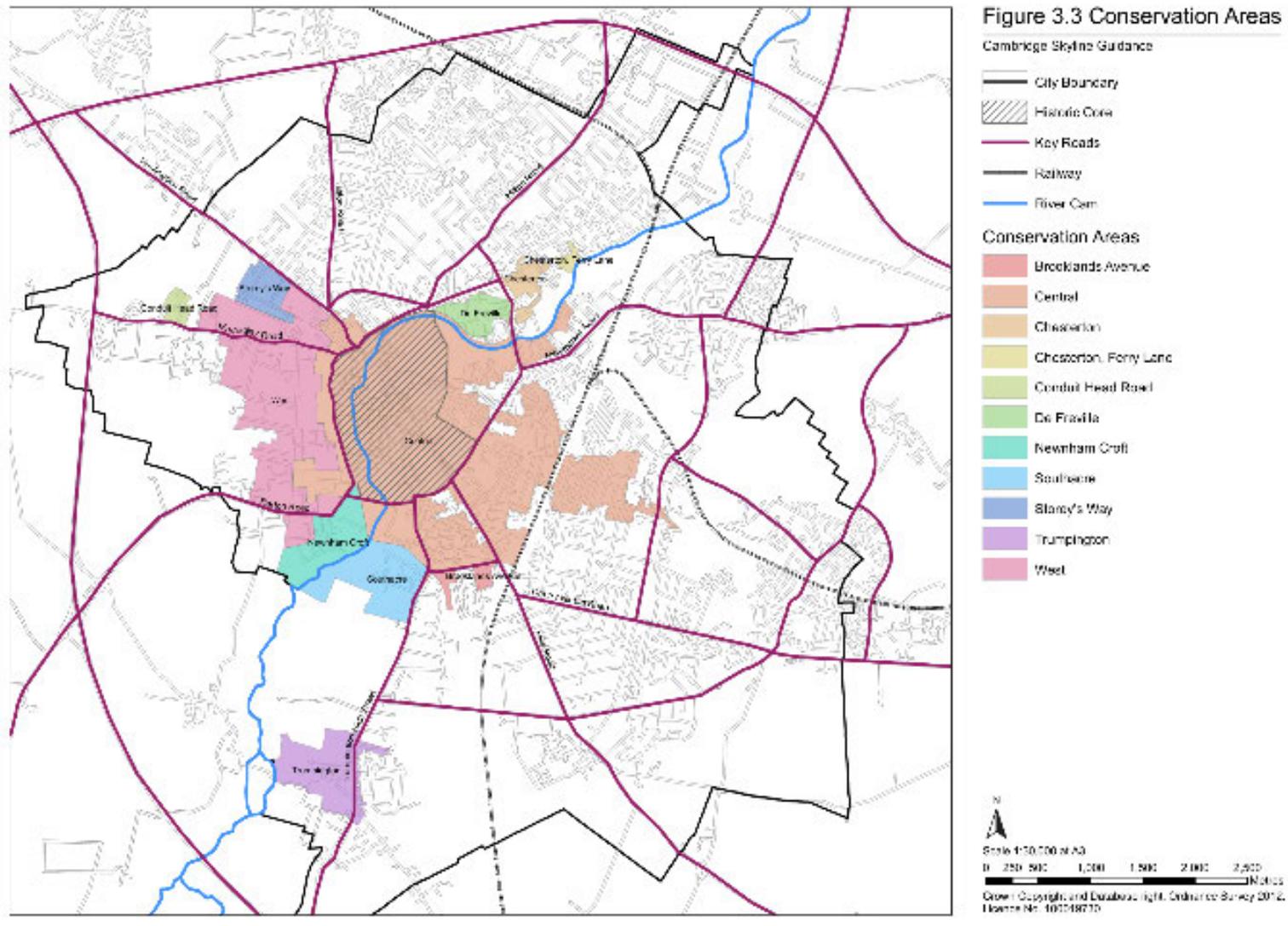


Figure 3—9 Cambridge City Centre Conservation Area

**Table 3—3 Council Decisions over project life**

| Decision     | Decision Maker                                 | Date                | Decision  |
|--------------|--|---------------------|---|
| DPD start    | Environment and Communities Scrutiny Committee | 29 June 2023        | <ul style="list-style-type: none"> <li>○ Provide 'In-principle' approval to use up to £180,000 of the Council's Climate Change Fund for match-funding of the next phase of DPD, subject to a satisfactory outcome from the feasibility study; a successful second government grant application; confirmation of a match-funding contribution from the University of Cambridge; clarification of additional expected resourcing requirements; and sources and approval from the Executive Councillor for Finance and Resources.</li> <li>○ Approve delegated authority to the Assistant Chief Executive (as heat network Project Sponsor) to make the final decision in consultation with the Executive Councillor, chair of Environment and Communities Scrutiny Committee and opposition spokes, once the Feasibility Study is completed in summer 2023.</li> <li>○ Note the potential requirement for a further additional Council and partner investment in technical assessment later, subject to exploration of alternative sources of funding.</li> </ul> |
| OBC approval | Cabinet  | Pending, March 2026 | Tbc   |

### 3.2.4 Why are we developing the Cambridge City Centre Heat Network?

#### Heating Is Key to Cutting Scope 1 & 2 Emissions

Heating and hot water are the single largest sources of building-related carbon emissions, responsible for around one-third of the UK's total footprint. Despite two decades of progress in power decarbonisation, emissions from heat have barely changed:

- 31% of domestic CO<sub>2</sub> comes from heating in the average home (Energy Saving Trust 2025)
- 85% of UK homes still rely on natural gas (Energy Security Net Zero Committee 2025)
- Only 5% use low-carbon heating (Energy Security Net Zero Committee 2025)
- Including industry, heating accounts for 37% of total UK emissions. (Energy Catapult 2025)

To meet Net Zero, virtually all buildings must transition from gas to **renewable and electrified heat**, through building-level systems, campus networks, or city-scale heat networks. Electrification of heating and hot water can be expensive. This is true for both available decarbonisation options - heat networks and building level heat pump

installations. This capital cost increases further when combined with building level energy efficiency improvements. This Energy Transition is necessary if we're to create a new, smarter and more decentralised energy system for the 21<sup>st</sup> century.

By 2050, government expects to see low carbon heat networks meet around one fifth of the UK's heating demand, reflecting the government's desire to support the lowest-cost, low-carbon solution. Government aims to double the size of the UK's heat network sector in the next 10 years, taking it from 2% to at least 7% (21TWh) by 2035.

**As government states in its recently produced Heat Zoning Consultation Response, heat networks are an essential part of our path towards lowering bills, decarbonising heat, enhancing energy security and achieving net zero by 2050.**

Crucially, heat networks enable use of heat sources that would otherwise not be available to consumers, such as waste heat from data centres and industrial processes, as well as higher temperature ambient sources (such as the River Cam).

As is noted in the government's recently published 'Heat Network Zoning Consultation Summary Response, heat networks can bring down the overall cost of electrifying the economy, saving money for all billpayers. By accessing larger sources of heat and operating at higher efficiencies than individual systems, they are estimated to save £5 to 7 billion in electricity distribution network savings alone.

Heat networks also help us make the most of the clean power system that is being built through their greater flexibility, using fuel-switching and large thermal stores to access cheaper electricity and save even more money.

The government's consultation response also notes that it is better to phase out the use of transitional gas boilers for peak heating later in the transition, to net-zero, when it will be easier to secure the additional investment needed to make heat generation low carbon, rather than adding these costs to heat network projects now, when they need high levels of capital investment. This is the approach we have taken with the Cambridge City Centre Heat Network (CCCHN).

### **In Cambridge, Decarbonisation Is Particularly Difficult**

Cambridge faces a unique heat decarbonisation challenge due to its historic built environment:

- A high proportion of *Grade I, II and II listed buildings\** restrict deep retrofits
- Poor insulation and fabric efficiency drive high heating demand
- Dense urban areas offer strong potential for shared low-carbon heat networks, especially where there's consolidated ownership. However, coordinating infrastructure installation, planning, lack of space and electrical grid upgrades to minimise disruption in a historic city centre is difficult. This challenge exponentially increases with multiple heat pump upgrades across individual Estates.

For the city's institutions and estates, transitioning from gas is already a widely accepted goal. The wide range of decarbonisation case studies in Appendix B, showcase how Strategic Partners are already decarbonising their Estates. Whilst the heat network creates a strategic decarbonisation benefit, it's by no means the only decarbonisation project happening.

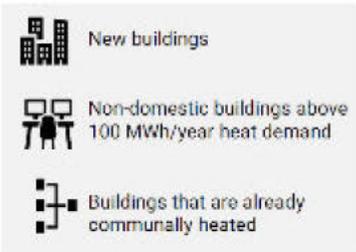
This prompts the important question - which scale of heat pump or network solution delivers the best overall cost, carbon and operational performance? An electrified baseload, with use of transitional gas for peak heating, is the now confirmed to be the baseline scenario. In common with many other new UK heat networks, this offers a pathway to full electrification after one lifecycle of peak heat gas boiler use (maximum of 15 years). It achieves a 93% reduction in carbon emissions, whilst ensuring that the project economics

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maximise customer connections in the Minimum Viable Product, providing the launchpad for a bigger heat network and even greater carbon savings.

Government has set an ambitious target to build an £80 billion UK heat market by 2050. Up to 20% of UK homes, around 6-7 million households and 1 in 5 homes, would be connected to a heat network (DESNZ 2024). To replicate the success of the UK's offshore wind industry sector, government has committed to support development of the UK heat network sector through policy, legislation and funding for all stages of heat network development. The UK government invested £288m in heat network development between 2022 and 2024. It is investing a further £435m between 2025 and 2028 (Capper 2023). In addition, the government has now successfully removed four of the main barriers to large-scale heat network development, as shown in Table 3—4.

**Table 3—4 Barriers to Large-Scale Heat Network Development**

|   | Barrier   | Mitigation  |
|---|---|---|
| 1 | <p><b>Lack of industry regulation / new regulations, impacting investment likelihood</b></p>  | <p>Heat Networks were an unregulated industry until the Energy Act 2023, supported by both the preceding Heat Network Metering and Billing Regulations 2014 (amended 2015 and 2020), and The Heat Networks (Market Framework) (Great Britain) Regulations 2025. This regulation ensures appropriate consumer protection for a monopoly utility supplier, with heat networks now regulated by Ofgem. The application and enforcement of this new legislation is untested. Whilst the basis of regulation has been drawn from other utilities, there are eccentricities in the UK Heat Network Market. There is a nervousness around utility investment and, the relationship between regulation, service provision, and capital growth, as exemplified in the water industry. As the regulations are rolled out, investors need to see that regulations and enforcement are proportionate, outcome focussed, and stable. CCCHN is being scoped to be best practice, taking regulations as the minimum standard.</p>  |
| 2 | <p><b>Lack of guaranteed heat demand:</b> critical to enabling capital investment in heat network infrastructure beyond the traditional red line development boundary</p> | <p><b>Heat Network Zoning</b> represents a major legislative change introduced through the Energy Act 2023. It establishes a framework for designating geographic zones, where heat networks are identified as the lowest-cost pathway for decarbonising heat. The heat zones will primarily be in cities and areas of high heat demand density. Within these designated zones:</p> <ul style="list-style-type: none"> <li>Specified building types will be mandated to connect to existing or planned heat networks from 2026 onwards, including:           <div data-bbox="524 571 880 823" style="border: 1px solid #ccc; padding: 5px; margin: 10px 0;">  <p>New buildings</p> <p>Non-domestic buildings above 100 MWh/year heat demand</p> <p>Buildings that are already communally heated</p> </div> </li> <li>Zoning will be coordinated locally, led by Zone Coordination Bodies (typically Councils) working with heat network developers, utilities &amp; Ofgem.</li> <li>The framework is designed to remove investment barriers by providing market certainty over long-term heat demand, to secure and unlock private finance.</li> <li>It also supports strategic network expansion, integration of waste and renewable heat sources, and the decarbonisation of dense urban areas, where individual building solutions are less practical or economic.</li> </ul> <p><b>Connection Exemptions</b></p> <p>Each Heat Zone will procure a Developer, with exclusive rights to design and build a heat network, thereby benefitting from heat loads that are mandated to connect. There are several exemptions, where heat network connections aren't required:</p> <ul style="list-style-type: none"> <li>Connection is not technically/economically feasible e.g. due to distance from the network route or insufficient heat demand.</li> <li>A building has recently invested in a low-carbon heating system that delivers equivalent or better emissions performance.</li> <li>The building is listed or heritage-protected, where physical connection could compromise fabric integrity or heritage value.</li> <li>The connection would breach existing contractual or operational constraints, such as long-term energy supply agreements.</li> </ul> <p>These exemptions are intended to ensure proportionality while maintaining the integrity and investment confidence of the zoning framework. Local Zone Coordinators &amp; Ofgem will oversee approval &amp; exemption governance to ensure consistent national application.</p> |

|   | Barrier                            | Mitigation  |
|---|------------------------------------|---|
|   |                                    | <p><b>Implementation</b><br/>Heat Zones are initially based on national government modelling, followed by local refinement, public consultation and designation of one or more specific Heat Zones by a newly appointed Zone Coordination Body. The current assumption is that this role could be filled by Cambridge City Council, noting that Devolution is also a factor. The government's Heat Network Zoning Consultation Response states that Zone Coordination Bodies could consist of a single body that fulfils all functions; a two-tiered multi-party structure; a multi-party structure with a lead local authority; or a consortium where resources are shared between different Zone Coordination Bodies. For example, a Zone Coordination Body may be led by a Combined Authority who delegates tasks to local authorities in their jurisdiction.</p> <p><b>Scale and Implementation of Heat Network Zoning</b><br/>The UK Government estimates that there could be up to 450 Heat Network Zones established across approximately 200 urban areas, including Cambridge (DESNZ, 2024a). These zones identify the areas where heat networks offer the lowest-cost pathway to decarbonising heat.</p> <p>It is anticipated that there will be a time lag between the national policy framework becoming operational and individual local zoning reviews being completed. For example, while zoning regulations are expected to come into effect, the formal zoning review for Cambridge is likely to follow at a later stage, once national guidance, data requirements, and governance structures are fully established. This phased implementation reflects the need for local capacity building, data standardisation, and coordination with wider spatial energy planning before full-scale delivery can commence.</p> <p><b>Cambridge Heat Zoning Study</b><br/>When deciding whether to connect to and potentially invest in the Cambridge City Centre Heat Network, it is important that Strategic Partners with land holdings across Cambridge are aware of the wider heat network expansion opportunity in Cambridge; and the requirement to connect large heat loads that's brought about by Heat Zoning legislation. This is why a parallel Heat Zoning Study for the entire city of Cambridge was commissioned in Spring 2025 and included as Appendix G. The Cambridge City Centre Heat Network provides the perfect launchpad for the identified heat network expansion across Cambridge, which has been quantified as over 100GWh in the City Centre and over 450GWh across the wider Cambridge area. Several important stakeholders have expressed an interest in future heat network connection.</p> |
| 3 | <b>Business Rates</b>              | Heat networks historically paid higher Business Rates than other utilities, making them less attractive to investors and harder to build. Under the Non-Domestic Rating (Heat Networks Relief) Regulations 2023, from 1 April 2024 eligible heat networks are now entitled to 100% relief from business rates, putting heat networks in an equivalent footing to other utilities.   |
| 4 | <b>Statutory Undertaker Rights</b> | <p>The Energy Act 2023, together with associated secondary legislation, provides powers to give heat networks enhanced rights analogous to those held by statutory undertakers of other regulated utilities:</p> <ol style="list-style-type: none"> <li>1. The Heat Networks (Market Framework) Regulations (Great Britain) 2025 set out that operation and supply of heat networks is a regulated activity requiring authorisation from Ofgem. The Heat Networks regulations phase in authorisations from 1 April 2025, with full regulatory enforcement from 27 January 2026.</li> <li>2. Authorised heat networks now have Undertaker-like-Rights, enabling them to undertake street works and excavate highways in the same manner as gas, electricity and water undertakers.</li> </ol>  |

### 3.2.4.2 Heat Networks – the Cambridge picture

In a heritage and space constrained location such as Cambridge city centre, the case for centralised energy centres and city-scale heat networks becomes more compelling. The local problem we're trying to solve is how to kickstart a city-scale heat network in Cambridge.

The proposed solution is to work as a strategic partnership to share collective responsibility, resource and budget to kickstart Cambridge City Centre Heat Network. Testing has been undertaken to determine whether it is viable and able to compete against local building level counterfactuals, so that Strategic Partners can decide whether to seriously consider connection at Commercialisation Stage.

Through the creation of a Minimum Viable Product, with the opportunity for significant betterment over time (as demonstrated by the parallel Heat Zoning Study), the project seeks to set the pathway and standard for future heat network developments in Cambridge.

The OBC for the Cambridge City Centre Heat Network provides the quantified evidence base to demonstrate that project delivery will deliver all primary and secondary Critical Success Factors (CSFs), with a wide range of Strategic, Decarbonisation and Customer benefits for Strategic Partners and wider stakeholders in the city centre and across Cambridge.

### 3.2.5 Strategic Partners

The scope of the project is to develop and deliver CCCHN, future proofing it for potential expansion to a much larger city-scale heat network across Cambridge. The primary driver is cost efficient decarbonisation. This fits well with the decarbonisation targets set by individual Strategic Partners.

As is shown by the wide range of decarbonisation case studies in Appendix B, Strategic Partners have made credible in-roads into decarbonising their estates and have great knowledge of what works and what doesn't. Strategic Partners are increasingly willing to share lessons learned with each other and beyond, helping maintain Cambridge's position as an established global brand.

CCCHN builds on this collective experience, which includes heat pump installations at Darwin College (RSHP), Gonville and Caius (ASHP), Pembroke College (ASHP) and Emmanuel (GSHP). Cambridgeshire County Council has developed the Swaffham Prior Heat Network.

Version number

The University of Cambridge has developed a heat network in Eddington and installed Ground Source Heat Pumps in West Cambridge.

The stretching carbon targets set by many Strategic Partners in Table 1 – 5 and the rate of decarbonisation shown in Table 1 - 6, mean that additional action is required and relatively quickly. CCCHN offers 93% carbon savings compared with Business-As-Usual (gas boilers and gas Combined Heat and Power units).

Work is underway to more accurately quantify a cost comparison with local counterfactuals, using cost data from these real-world decarbonisation projects in a historic and space-constrained city centre.

Even in those limited cases where the heat network is slightly more expensive than the local counterfactual, connecting to CCCHN may still be the preferred option for the reasons listed in Table 3—9. It may also be the only deliverable solution in a historic city centre and Conservation Area, where lots of individual heat pumps would be visually intrusive and challenging from a planning perspective. Local grid constraints might also prohibit building and/or on-site heat pump solutions.

Conversely, it is accepted that CCCHN is not the most appropriate solution for every building, especially those with relatively low annual heat demands, or that are hard to access, especially if they're isolated by archaeological, conservation or practical constraints. College and University site visits in 2025 identified several buildings for exclusion from the Minimum Viable Product, where it is recommended that independent building level heat solutions are instead explored.

Importantly, for any Institutions that ultimately decides to stay with gas for longer than MVP Phase 1 (2030-2033 Heat On) or MVP Phase 2 (2035 to 2037 Heat On), it is important to note that there is a **cost of doing nothing**.

By not future installing the primary pipework to connect individual buildings and campuses to the renewable energy centres, the opportunity to connect to CCCHN may be lost for many years. The amount of cost and disruption incurred by installing 8km of primary network in Cambridge's historic centre is likely to be significant. The opportunity to return may be difficult in the short to medium term. The preferred approach is, where possible, to only dig once to minimise disruption to all stakeholders.

**Table 3—5 Strategic Partners' Decarbonisation Targets.**

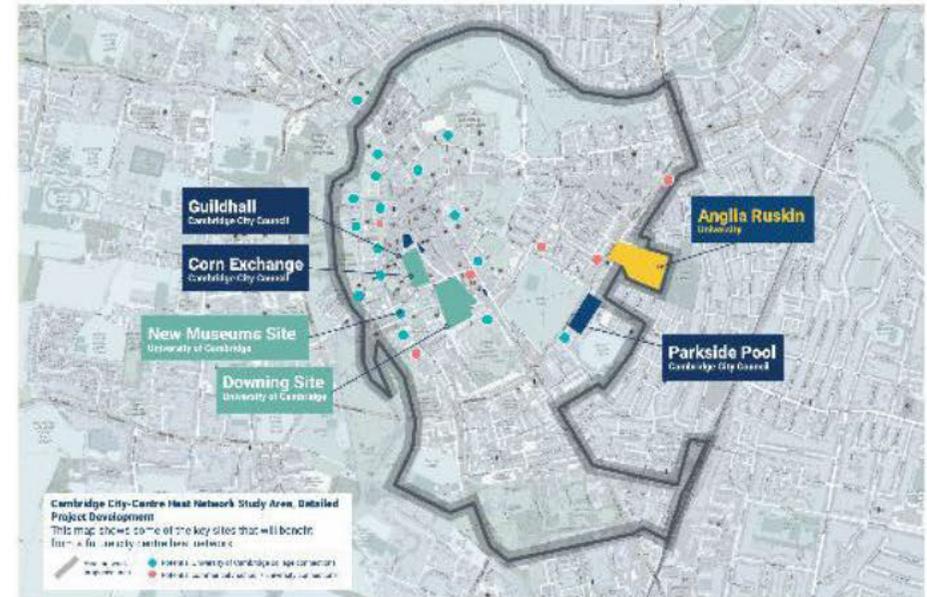
| Organisation                  | Decarbonisation Target   |
|-------------------------------|--|
| Cambridge City Council        | <p>Reduce the Council's direct carbon emissions to net zero carbon emissions by 2030. Climate Change Strategy 2021-2026 (Cambridge City Council 2021) includes six objectives. Objectives 1, 2, and 6 are embedded within the heat network's Project Objectives, creating strong strategic alignment.</p> <p><b>Climate Action Plan</b></p> <ol style="list-style-type: none"> <li>4. Reduce emissions from City Council buildings, land, vehicles and services</li> <li>5. Reduce energy consumption and carbon emissions from homes and buildings in Cambridge</li> <li>6. Reduce emissions from transport by promoting active travel and public transport, and encouraging a shift to electric vehicles and other alternative fuel sources</li> <li>7. Reduce consumption of resources and waste, and increasing repair, re-use and recycling of goods and materials</li> <li>8. Promote sustainable and local food sources</li> <li>9. Support Council services, residents and businesses to adapt to the impacts of climate change</li> </ol>   |
| Cambridgeshire County Council | <p>Cambridgeshire's carbon emissions will be Net-Zero by 2045. The County Council will reduce emissions from our buildings and fleet transport to net zero by 2030 (Scope 1 &amp; 2). Projects delivered by the Council include:</p> <p>Decarbonisation of heating in all Council buildings<br/>           Installation of local energy generation on available sites, &amp; switching to 100% renewable energy<br/>           Investments in green transport and biodiversity</p>   |
| University of Cambridge       | <p>The University of Cambridge was the first university in the world to announce adoption of a 1.5 degrees Science Based Target for carbon reduction, committing itself to reduce its energy-related carbon emissions to absolute zero by 2048. This requires a steep 75% decrease on 2015 emissions by 2030. The University is seeking to achieve absolute zero by 2048.</p> <p>Practical steps to achieve this ambitious goal includes:</p> <p>Procuring zero carbon electricity<br/>           Reducing gas use<br/>           Managing heating &amp; cooling<br/>           Supporting energy efficient research<br/>           Carbon Reduction Fund, an in-house mechanism to lever additional project funding to help reduce the University's carbon emissions.<br/>           Reducing the carbon impacts of construction<br/>           Reshaping the Estate, a strategic estate transformation programme led by the University's Estates Division. Its primary aim is to deliver an estate that is more efficient, effective, environmentally sustainable and fit-for-purpose, supporting world-class teaching &amp; research.</p> |
| Anglia Ruskin University      | <p>ARU has published plans to reduce direct (Scope 1 &amp; 2) emissions of carbon to zero by 2035 and all indirect (scope 3) emissions to zero by 2045, without the use of carbon offsetting. The ARU Climate Positive Plan includes measures to:</p> <p>Decarbonise all heating<br/>           Replace all fleet vehicles with electric alternatives<br/>           Strengthen the sustainable construction standards of new buildings and refurbishments<br/>           Purchase zero-carbon electricity<br/>           Strengthen management of business travel and reduce short-haul flights<br/>           Work with suppliers to obtain carbon data for goods and services and identify improvement opportunities.</p>   |
| 17 Colleges                   | <p>Each College is working to decarbonise their carbon emissions, several with published decarbonisation targets. Some use Science Based Targets with fixed deadlines, whilst other Colleges are working on a project-by-project basis for each building as needs arise. All Colleges have committed resource to the decarbonisation of their Estates.</p>   |

**Table 3—6 Carbon Reduction Progress**

| Organisation                  | Target                | Progress  |
|-------------------------------|-----------------------|---|
| Cambridge City Council        | Net Zero by 2030      | Scope 1 emission reduction in 2023/24, from 2014/15 baseline: 16%<br>Total emissions reduction in 2023/24, from 2014/15 baseline: 48% |
| Cambridgeshire County Council | Net Zero by 2045      | Scope 1 & 2 emissions reduction in 2019/20 from 2014/15 baseline: 48%   |
| University of Cambridge       | Absolute Zero by 2048 | Reduced Scope 1 & 2 emissions in 2023/34 from 2015-16 baseline: 67%   |
| ARU                           | Absolute zero by 2045 | Scope 1 & 2 emission reduction in 2023/24, from 2014/15 baseline: 73%   |
| Colleges                      | Individual targets    | Not measured as a collective target.  |

### 3.2.6 Setting the DPD Study Area

The DPD Study Area is shown in Figure 1-10. It was set to give the best chance of developing a viable Minimum Viable Product (MVP) using city centre located anchor heat loads from the 20 Strategic Partners with anchor heat loads, whilst not incurring the expense of crossing either the River Cam or the railway line. The Study Area includes 3 of the 4 Clusters identified at Feasibility Study.



**Figure 3—10 Cambridge City Centre Heat Network Study Area**

Local authority responsibility for the Study Area is currently split between:

#### Cambridge City Council

Local Planning Authority (LPA) via Greater Cambridge Shared Planning Service, together with South Cambridgeshire District Council: responsible for integrating heat networks into spatial planning, development management, and Local Plan policies (e.g. setting connection requirements for new developments)

Climate & Sustainability Strategy: the City Council leads city-level net zero & decarbonisation initiatives, including emissions tracking and stakeholder engagement

Likely heat network asset owner of a customer owned energy company, together with several other Strategic Partner equity investors. Likely customer and equity investor in CCCHN

Building and estate management: oversees council housing, public buildings, and estates that could be mandated or prioritised for network connections.

### **Cambridgeshire County Council**

Highway Authority: Responsible for consenting and coordinating street works and excavations for heat network installation and maintenance

Energy and infrastructure planning: Leads county-wide Local Area Energy Plan (LEAP) development and delivery, infrastructure coordination, and engagement with regional and national initiatives

Economic development and skills: Supports heat network growth through workforce development, business support, and coordination with major infrastructure programmes.

The role of Zoning Coordinator has yet to be confirmed. The working assumption is that it will be undertaken by Cambridge City Council. However, the ultimate decision will be affected by devolution. DESNZ has also stated that its general preference is for the Mayoral/Combined Authority to act as the Heat Zone Coordinator, overseeing zone designation, procurement of zone developers, and enforcement of mandated connections.

In the meantime, Strategic Partners continue to push CCCHN development, subject to the obtaining the individual and collective governance approvals required to move to Commercialisation Stage.

## **3.3 Project Objectives**

Within the context of the Vision to enable heat on by 2030, Strategic Partners jointly agreed five Project Objectives in Autumn 2024:

1. **Make Cambridge Greener Quicker:** we aim to provide Cambridge city-centre with clean and renewable heating. By avoiding harmful energy sources, we keep the air clean and protect the city's older buildings. Heat networks can be the most cost-effective way of achieving this, helping to protect against rising energy costs, positioning Cambridge as a leader in sustainable urban living.
2. **Strategic Collaboration:** by working together, project partners can de-risk their own decarbonisation by strategically addressing shared challenges in planning, conservation, decarbonisation funding, power limitations and infrastructure construction. This collaboration opens up additional public sector funding opportunities and unites efforts towards shared carbon reduction goals. We are supported by an Expert Advisory Group of world-leading experts, led by Professor Ruchi Choudhary.
3. **Spread the Benefits across Cambridge:** CCCHN provides a starting point for broader heat network expansion across Cambridge, further bolstering the project Business Case. The public sector, universities, schools, houses and businesses can ultimately connect and use cleaner energy, making the entire city a healthier and better place to live for everyone.
4. **Boost the Local Economy & Innovation:** the heat network could be more than just a way to keep buildings warm. It could also support a 'Heat Network Digital Twin' for new ideas and business growth. This will help improve the heat network's operational performance, may reduce customer tariffs and create a circular economy. This could lead to new inventions, smarter ways to use renewable energy and make Cambridge a sustainable energy leader.
5. **Future-Proof Cambridge:** the heat network will play a pivotal role in reducing the cost of electricity upgrades as we electrify heat. We will reduce the city's peak electricity consumption during high tariff periods, helping Cambridge efficiently manage its energy system. The heat network will fully integrate with existing buildings and new development sites.

In January 2025, Strategic Partners went one step further and jointly agreed CCCHN's Critical Success Factor (CSFs), as shown in Table 3—7.

CSFs are strategic priorities that must be delivered by a successful CCCHN project. They are Strategic Partner must haves and were collectively agreed, with remarkable consensus between 21 Strategic Partners. The CSFs and supporting evidenced in the Outline Business Case, are the basis upon which Strategic Partners can individually and collectively determine their future roles in the project.

**Table 3—7 Critical Success Factors, Cambridge City Centre Heat Network**

### Critical Success Factors Table

#### Primary

1. Help decarbonise individual Estates, while enabling potential future heat network expansion
2. Provide cost-competitive & reliable low carbon heat:
  - a. Offer low carbon energy that is better value over contract lifetime against counterfactual(s)
  - b. Provide long-term reliability and at minimum, heat supply availability in line with industry standards

#### Secondary

1. Maximise social value & education
2. Minimise disruption & share the benefit from construction across the city
3. Showcase sustainability leadership & innovation

### 3.4 Benefits Being Sought

The Cambridge City-Centre Heat Network creates a unique collaborative opportunity, delivering impact far beyond the sum of its parts. CCCHN can showcase Cambridge’s economic, environmental and social sustainability to an international audience, providing a practical demonstration of how to decarbonise a historic city centre and create a truly sustainable place.

Most importantly, the OBC provides the evidence base to confirm that the MVP delivers all primary and secondary CSFs set by Strategic Partners at the start of DPD in Autumn 2024. See Table 3—8.

**Table 3—8 Strategic Benefits and Critical Success Factors**

|   | <b>PRIMARY CRITICAL SUCCESS FACTORS</b>  | <b>Evidence</b>  |
|---|--|--|
| 1 | Help decarbonise individual Estates, whilst enabling potential future heat network connections   | Carbon savings against the gas ‘Business as Usual’ scenario for MVP Phase 1 and 2 are estimated to save 506,000 tonnes and deliver 93% decarbonisation over the 40-year Business Plan.   |
| 2 | Provide cost competitive and reliable low carbon heat <ul style="list-style-type: none"> <li>○ Offer low carbon energy that is better value over contract lifetimes</li> <li>○ Provide long-term reliability and as a minimum, provide heat supply availability in line with industry standards</li> </ul> | Local cost comparisons have been issued to Individual Strategic Partners, showing forecast heat network cost estimates versus local counterfactuals for each bulk heat supply connection point. This data is confidential, only being supplied directly to each Strategic Partner. The case for developing CCCHN depends on this local counterfactual comparison, as shown in the Economic Case. Using standardised heat network cost assumptions, whilst the blended counterfactual is more expensive, local cost comparisons are within the Margins of Error. Real world counterfactual construction and operational cost data are due to be shared by the University of Cambridge, potentially demonstrating that real word counterfactual costs for decarbonisation costs in Cambridge are higher. Additional real-world examples are also being sought from Colleges to ensure effective decision making by Strategic Partners at Final Investment Decision.  |
|   | <b>SECONDARY CRITICAL SUCCESS FACTORS</b>  | <b>Evidence</b>  |
| 1 | Maximise social value and education  | <p>Strategic Partner senior officer representatives confirmed their support for exploring the concept of a Heat Network Digital Twin in Autumn 2025. As a result, the heat network team is applying for external funding to prove the concept [REDACTED]. [REDACTED] The funding bid is built upon both the strength of CCCHN’s strategic partnership and Cambridge’s academic prowess.</p> <p><b>Strategic Benefits</b></p> <ul style="list-style-type: none"> <li>• Strengthens the Cambridge City Centre Heat Network business case across all Critical Success Factors (decarbonisation, cost, tariffs, reliability and social value).</li> <li>• Enhances competitiveness of the Green Heat Network Fund bid, which is essential to project viability:</li> <li>• Lays the groundwork for a city-scale Living Lab, aligned with Cambridge’s growth and innovation agenda.</li> <li>• Aligns with Cambridge City Council corporate objectives, University of Cambridge’s research ambitions, and ARU’s Sustainable Futures programme.</li> </ul> <p><b>Operational Benefits</b></p> <ul style="list-style-type: none"> <li>• Supports delivery of a 21st-century heat network using real-time optimisation.</li> <li>• Reduces tariffs and improves resilience through predictive asset management.</li> </ul> |

|   |   |  |
|---|---|--|
|   |   | <ul style="list-style-type: none"> <li>• Future-proofs the network through scalable data integration and extensibility.</li> </ul> <p><b>Academic Benefits</b></p> <ul style="list-style-type: none"> <li>• Unlocks a real-time city-centre dataset for research and teaching. Cambridge already has significant expertise and relevant case studies.</li> <li>• Enables interdisciplinary applied research and postgraduate projects.</li> <li>• Complements the Cambridge Digital Twin Programme with the Cambridge Institute for Sustainability Leadership (CISL), where the heat network is a potential flagship project.</li> </ul> |
| 2 | Minimise disruption and share the benefit of construction across the city | <ul style="list-style-type: none"> <li>• Managing disruption - see Top 5 Heat Network Risks and Mitigation in Figure 1 - 11.</li> <li>• Require reinvestment of a percentage of profits in social value delivery in Cambridge.</li> </ul>  |
| 3 | Showcase sustainability leadership and innovation                         | <ul style="list-style-type: none"> <li>• Sustainability leadership and innovation are demonstrated by:</li> <li>• 21 Strategic Partners</li> <li>• Construction of a heat network in a historic and space-constrained city centre</li> <li>• Senior officer commitment from Strategic Partners to seek external funding to prove the concept of a Heat Network Digital Twin</li> </ul>   |

The strategic benefits of the Cambridge City Centre Heat Network linked to the Project Objectives shown in Table 3—9.

**Table 3—9 Strategic Benefits & Project Objectives, Cambridge City Centre Heat Network**

| No.                                   | Theme  | SMART Objective   | Status  |
|---------------------------------------|--|---|---|
| <b>Make Cambridge Greener Quicker</b> |  |   |   |
| 1                                     | <b>Deliverability</b>  | A centralised network reduces project delivery costs and effort.<br>In addition to the cost and carbon comparisons made, local counterfactual comparisons also need to account for strategic risks, grid constraints, the commercial benefit of any Contributions in Kind and how realistic it is for Partners to develop and deliver multiple on-site heat decarbonisation projects in the time available. | The lifetime cost of heating for the City Heat Network is [REDACTED] lower when compared to the blended counterfactual.<br>Local counterfactual data is being updated, in line with local real world counterfactual data that is being provided by Strategic Partners.  |
| 2                                     | <b>Secured strategic connections</b>                             | One connection per Strategic Partner grouping is tight but potentially deliverable by the end of 2030, with all Strategic Partner city centre MVP sites connected by 2036.<br>The heat network option streamlines funding, planning, programming, and approvals for all stakeholders.<br>CCCHN helps customers meet decarbonisation and net zero targets more swiftly and efficiently.                      | Targeted phasing plan in place, allowing connection of:<br>Grade I, Grade II* & Grade II Listed Buildings via high temperature network, with limited visual impact. In contrast, multiple building & campus heat pump installations is likely to have a significant visual impact in a heritage & space constrained city centre.<br>Accommodates both early adopters pushing for net zero by 2030, and Strategic Partners who've replaced gas boilers and wish to wait until end of their useful life.<br>CCCHN is technically able to connect lower temperature ambient heat networks. |
| 3                                     | <b>Significant carbon savings</b>                                | 90%+ carbon savings over gas boilers targeted<br>10% carbon savings over individual ASHP solutions targeted   | Design currently achieves these targets, with an overall 93% carbon saving against Business as Usual. Carbon savings vary for individual connections. The heat network has marginally greater carbon savings, due to the lower heat pump fraction in the blended counterfactuals. The big heat network benefit is that it's deliverable with this Business Case. Individual savings depend on the deliverability of on-site solutions.  |
| 4                                     | <b>Sustainability leadership</b>                                 | Be a demonstrator project for 100% renewable solutions, with no waste heat sources, in Cambridge's conservation and heritage context.   | On target   |
| 5                                     | <b>Derisk stakeholder decarbonisation</b>                        | Minimise heat network planning risk<br>Create a pathway for secondary heat network development<br>Secure heat network developer and transfer appropriate level of risk  | Three initial Planning Performance Agreement meetings indicate positive outlook for energy centre and building connection delivery.<br>Potential to set up a secondary heat network development framework proposed.<br>Soft market testing in early 2026 for feedback on proposed risk transfer model.  |
| 6                                     | <b>City-wide expansion</b>                                       | Identify major anchor loads with potential to support ongoing heat network development, evident with Letters of Support   | Two additional anchor heat loads in Cambridge city centre engaged   |
| <b>Strategic Collaboration</b>        |  |   |   |
| 7                                     | <b>Customer benefits</b> Market readiness                        | Present a robust 40-year business case, demonstrating the strength of customer base in the MVP. The historic, long-standing and high-profile nature of our Strategic Partners should be hugely appealing to the heat network market, driving cost competitive customer tariffs.   | Tbc via soft market testing, Q1 2026.   |
| 8                                     | <b>Customer Benefits:</b> Cost effective for individual partners | Centralisation of CapEx, OpEx and RepEx to reduce whole-life heating costs for the customer's alternative   | Levelised Cost of Heat estimated at [REDACTED] (incl. GHNF) [REDACTED]<br>[REDACTED]  |

|                                  |  |   |   |
|----------------------------------|--|---|---|
| 9                                | <b>Customer Benefits</b><br>Resilience & efficiency      | CCCHN can provide resilience in terms of contractual heat arrangements, legislated efficiency, and practical measures.  | Resilience Note prepared and distributed to customers. See Appendix R.  |
| 10                               | <b>Customer Benefits:</b><br>Securing customer base      | Targeting 100% of available connections from Strategic Partners with city centre assets in the MVP.   | High temperature heat network identified as best option, enabling connections to be offered to all 20 Strategic Partners with anchor heat loads in Cambridge city centre. |
| 11                               | <b>Customer Benefits</b><br>Procurement                  | As suggested at the College Update Workshop in June 2025, if there is Strategic Partners demand, the DBOM tender specification can be expanded to include an option for consultancy to support secondary heat network upgrades  | Tbc by Strategic Partners at Commercialisation Stage.   |
| 12                               | <b>Economies of scale</b><br>Growth potential identified | Test potential for expansion through Zoning Study. Scaling up the heat network will provide greater demand and supply diversity, improving efficiency, heat pricing, and carbon reduction for an expanded customer base.  | See Heat Zoning Study, which identified a further 30GWh of heat in the city centre and almost 500GWh in the wider Cambridge city area.                                    |
| <b>City Benefits</b>             |  |   |   |
| 13                               | <b>Improved air quality</b>                              | Reduce carbon impact of heating in Cambridge. This is a key health benefit, adding to the previous reduction in traffic pollution. The Cambridge City Centre Air Quality Management Area for nitrogen dioxide was revoked in 2025.  | Carbon reduction is 506,000 tonnes over 40 years (Economic Case, Figure 2)  |
| 14                               | <b>Biodiversity Uplift</b>                               | Energy centre development areas to boost Biodiversity by at least 10%.  | Biodiversity Net Gain Study   |
| 15                               | <b>Producing value from existing assets</b>              | Uplift in value and revenue by adapting existing publicly owned assets to become renewable energy centres   | To be calculated at Commercialisation   |
| <b>Boost the Economy</b>         |  |   |   |
| 16                               | <b>Supply chain</b>                                      | Opportunities for:<br>Use of local supply chain<br>Development of local supply chain<br>Training and youth employment   | Targets to be defined at Commercialisation  |
| 17                               | <b>Social Value</b>                                      | Target % of profits to be reinvested in expansion of CCCHN and energy retrofits via the Cambridge Pledge., to strengthen our <i>GHNF bid</i> . No up-front capital is required by Strategic Partners. It makes full use of existing and separate governance arrangements. It also delivers the social value expectations of the Council, who are project facilitators and contributing energy centre land. Competitive energy tariffs will still be provided to Strategic Partners. | Concept development ahead of GHNF funding bid in Spring 2026  |
| 18                               | <b>Heat Network Digital Twin</b>                         | Test social, research and financial value of developing an infrastructure dataset and Heat Network Digital Twin.  | Tbc via Proof of Concept, subject to a successful external funding bid in first half of 2026  |
| <b>Future Proofing Cambridge</b> |  |   |   |
| 19                               | <b>Electricity resilience</b>                            | Reduce local electrical upgrade requirements across Cambridge from the electrification of heat. Potential upgrades required for local heating systems is estimated to be at least 50% of proposed connections.  | Grid upgrades will only be required at energy centre locations  |
| 20                               | <b>Expansion potential</b>                               | Identification of potential customers to back-fill excess heat demand due to successful energy retrofits, in unlikely event of no heat network expansion.   | Significant expansion potential confirmed by Heat Zoning Study. [REDACTED]  |

### 3.4.1 10 Reasons to Connect to the Cambridge City Centre Heat Network

The following ten reasons to connect to the Cambridge City Centre Heat Network have been presented to the Strategic Partners, potential customers of the development. These outline reasons for connection beyond the cost and carbon comparison that each customer is expected to make.

Table 3—10 10 Key Reasons for CCCHN

| Reasons To Act   |   | Strategic Benefits of the Cambridge City Centre Heat Network (CCCHN)  |
|--|---|---|
| 1. Cost effective  |    | CCCHN is cost effective compared to the blended counterfactual.   |
| 2. Control of energy tariffs                                       |    | A customer led Delivery Model is being developed to help Strategic Partners retain control of their energy tariffs. Unlike private sector models, Strategic Partners use capital investment to hedge against energy price hikes.  |
| 3. Better carbon savings:  |    | Strategic Partners can be supplied with very low carbon heat, with a 93% carbon reduction. It uses economies of scale to deliver the pace of change needed in the timeline available. This sustainability leadership provides a strong Cambridge response to the Climate Emergency, whilst helping deliver clean air in the City Centre.  |
| 4. Better reliability  |    | Thermal stores enable access to time of use tariffs and cheaper nighttime electricity, helping reduce electricity bills. This option generally isn't available at a local level due to space, conservation & planning constraints. The heat network team is working with English Heritage to explore conservation appropriate thermal store designs to help engage the public on the Energy Transition.                                     |
| 5. More deliverable  |    | Minimal visual impact in City Centre Conservation Area, compared to many individual heat pump solutions in a heritage & space constrained city centre. The heat network has developed early strategic relationships with statutory consultees, including the Environment Agency, Archaeology, Highways, Historic England, Greater Cambridgeshire Partnership, Greater Cambridge Shared Planning, Local Area Energy Plan & UKPN.             |
| 6. Access to decarbonisation grant funding                         |    | Green Heat Network Fund grant can only be accessed via the Cambridge City Centre Heat Network. The Public Sector Decarbonisation Scheme has recently been withdrawn by government.  |
| 7. City Council's facilitation role, working closely with Partners |   | This is the glue that binds our efforts together, with policy levers, cross-party political support and close work with Strategic Partners to client the heat network project. This facilitation role isn't available with on-site decarbonisation projects, reducing the opportunity for a strategic solution that benefits everyone.  |
| 8. Reduced 'Hassle Factor' for decarbonisation delivery            |  | The heat network project makes best use of limited capital, revenue and resource, with fewer governance approvals. Decarbonisation funding, grid, conservation & planning challenges move to the heat network project, which has far fewer energy centres.  |
| 9. Betterment opportunities  |  | These are being explored through Sensitivity Analysis, including an additional River Source Heat Pump (RSHP) Energy Centre and two additional potential thermal store locations. Much longer-term, opportunities could include heat network expansion connection to new data centre(s) and/or solar farm.   |
| 10. Heat Zoning Study  |  | The Heat Zoning study identified Heat Zones across Cambridge with 6x the City Centre heat demand. This includes a significant, potentially interconnected area expanding upon the initial City Centre Heat Zone. There is up to 50% additional heat demand in the City Centre amongst buildings that could be 'Required to Connect'. Inclusion of infill, or expansion would further improve the Business Case for customers and investors. |

### 3.5 Inter-dependencies, Assumptions and Constraints

There are high level internal and external factors that affect successful project delivery. These interdependencies, together with their associated risks and benefits, are listed in Table 3—11. The heat network team has also identified several betterment opportunities, which are being investigated to further strengthen the OBC:

- Potential additional energy centre, using RSHPs to top up the main RSHP energy centre at Midsummer Common
- Thermal Stores at two potential Strategic Partner sites; subject to RIBA Stage 2 design. Design principles discussed in Planning Performance Agreement meeting in December 2025

**Table 3—11 Project Interdependencies**

| No. | Interdependency                                     | Risks  | Benefits   |
|-----|---|--|--|
| 1   | Local government reorganisation                     | Political risk that CCCHN is stalled by uncertainty created through governance transition period   | Potential that City and County services fall under a single local authority  |
| 2   | Cambridge City Council: Civic Quarter redevelopment | May require phasing of some highways elements to prevent re-delivery   | Large-scale development going before heat network construction<br>Opportunity for co-delivery of works   |
| 3   | University of Cambridge: Reshaping our Estate       | Heat network connections are delayed or deemed inappropriate   | Optimum timing for the University to consider heat network development as it reshapes its Estate.<br>Connection opportunities can be refined.  |
| 4   | Energy retrofit of Strategic Partner buildings      | Capital constrained budgets and historic nature of buildings, make energy efficiency improvements too expensive to do quickly and at scale.                              | High temperature heat network solution enables maximum number of connections, with buildings able to connect, regardless of whether the energy efficiency of the building fabric has been improved. This mitigates the heat demand risk, whilst increasing operational costs. Possible co-delivery of projects, to prevent further disruption in city centre   |
| 5   | Heat Network Zoning                                 | Mandating connection of large heat loads becomes contentious and leads to stakeholder push back and appeals using 'exemptions'   | Mandating heat network connections is a game changer for heat network expansion, significantly derisking the Cambridge City Centre Heat Network project. Nonetheless, we're still focussing on the benefits and added value, to incentivise connection regardless of legislation.  |
| 6   | Local Plan Consultation                             | None   | Heat network development has been included in new Local Plan, offering an early consultation opportunity ahead of any specific heat network development.   |
| 7   | UKPN Grid Reinforcements                            | If it's not coordinated at a strategic level, electrical grid reinforcements could become prohibitively expensive to on-site and heat network decarbonisation solutions. | The new Local Area Energy Plan (LAEP) for Cambridgeshire enables co-ordination of long-term electrical grid development for Cambridge and CCCHN. The heat network team's UKPN Budget Application minimises the risk and maximises strategic alignment, with long lead in periods common for both power grid upgrades and heat network infrastructure delivery. |

### 3.6 Identify, Assess and Mitigate High-Level Potential Risks

The Cambridge City Centre Heat Network has a Risk Register (Appendix C) from which the top 5 Strategic Risk and Associated Mitigations in February 2026 were:

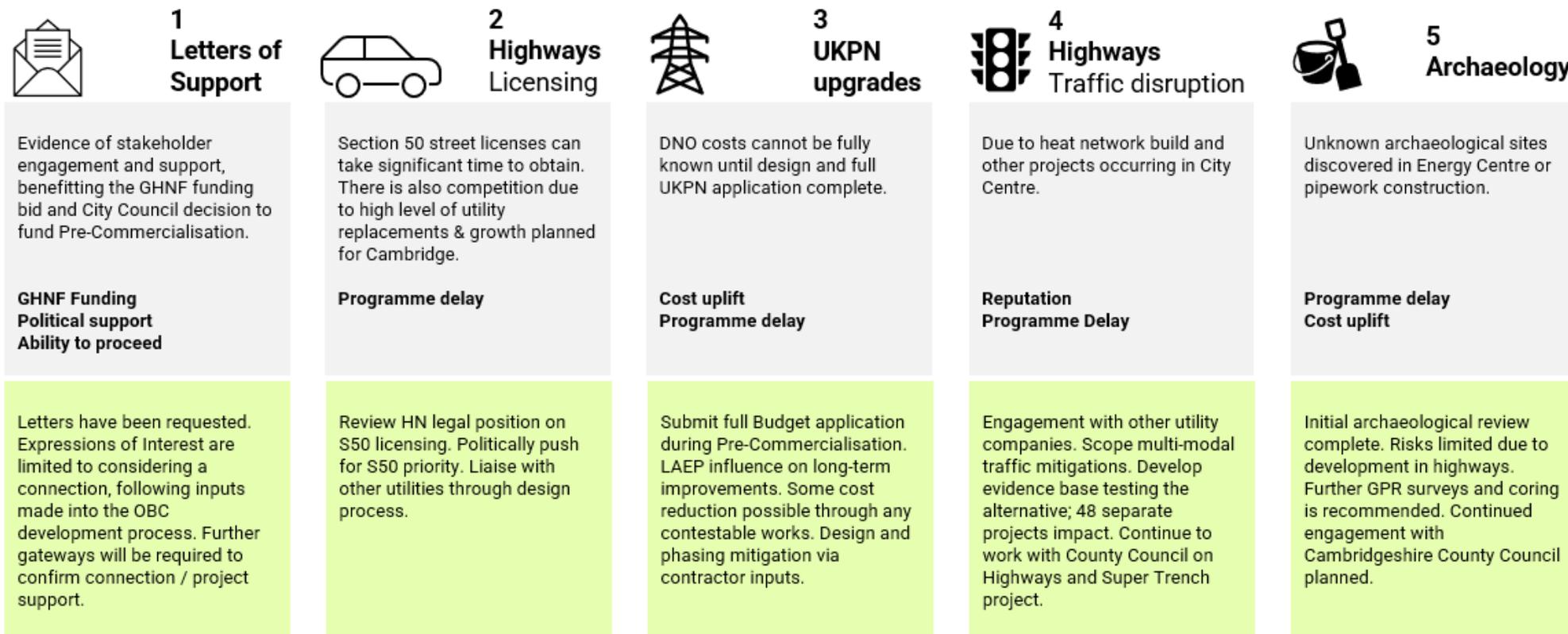


Figure 3—11 Top 5 Strategic Risks and Associated Mitigations

In addition to delivery risks, there are risks posed by Strategic Partners choosing an alternative to CCCHN. If insufficient Strategic Partners choose to connect, the viability and investor attractiveness of MVP Phase 1 & 2 is impaired.

It is important to highlight that there's also a **cost of doing nothing**. Sticking with gas as the main heating source in the interim isn't a risk-free option. As well as potentially contradicting individual Strategic Partner Decarbonisation Strategies, there's a reasonable likelihood that fossil fuels will be phased out in the short to medium term.

Although government has yet to legislate a ban on selling or installing gas boilers, the direction of travel is an energy transition, moving from fossil fuel dependency to the full electrification of heat. In addition, for heat loads over 100MWhr/year heat demand, Heat Zoning is likely to mandate heat network connections.

In situations where an on-site heat pump solutions are not deliverable (due to decarbonisation funding, space, planning, conservation and/or grid constraints), heat network connection is likely to be the only realistic decarbonisation option.

Even if the counterfactual solution is more cost effective, it should be considered in the context of the strategic risks in Table 3—12.

Table 3—12 Strategic Risks of Strategic Partners choosing not to connect CCCHN

| Strategic Risks if CCCHN Doesn't Happen   | Risk   |
|---|--|
| <b>Scale &amp; Timing</b>   | Strategic Partners unable to individually and collectively balance ambition and practical delivery, preventing the efficient decarbonisation of buildings and campuses in the limited time available, noting that we're in a Climate Emergency. This prevents 'Heat On' by 2030 as per the project's Vision.   |
| <b>Common challenges of decarbonisation funding, electrical grid, conservation &amp; planning constraints</b> | Strategic Partners face common decarbonisation challenges of funding, conservation, planning, space and grid constraints, as they seek to electrify their building stock. Without CCCHN, Strategic Partners miss the unique opportunity for historic institutions to work together to develop a strategic and pooled decarbonisation solution in a timely manner, making best use of limited capital, revenue and resource. This prevents a strong and resource-efficient response to the Climate Emergency.   |
| <b>Low-Cost Finance</b>   | Gated metrics prevent Strategic Partners from individually bidding to access to zero and low-cost decarbonisation funding through both the Green Heat Network Fund (GHNF) and National Wealth Fund (NWF).  |
| <b>Hassle Factor</b>  | Without a centralised solution, the hassle factor of delivering and maintaining at least 48 individual and separate on-site heating and hot water degasification projects increases.   |
| <b>Active facilitation</b>  | <p>Without CCCHN, Strategic Partners lose the City Council's facilitation role and work with Strategic Partners to:</p> <ul style="list-style-type: none"> <li>Convene the necessary funding and governance arrangements.</li> <li>Procure and client the existing heat network team, which has successfully taken CCCHN from Heat Mapping and Masterplanning Study to DPD.</li> <li>Maintain successful strategic partnerships with both DESNZ and NWF.</li> <li>Continue to strategically engage Greater Cambridge Partnership; Environment Agency, Historic England and UKPN.</li> <li>Continue strategic engagement with Cambridgeshire County Council to access specialist archaeological, highways and strategic energy masterplanning expertise. This includes ensuring strategic alignment coordination with the LAEP</li> </ul> |
| <b>Climate leadership</b>   | By not joining the MVP, Strategic Partners risk undermining a viable and strategic decarbonisation project. This creates a reputational risk and a delivery risk for stretching decarbonisation targets set by several Strategic Partners.   |
| <b>Significant heat demand and expansion opportunity</b>  | By not participating in a kickstart heat network in Cambridge City Centre, Strategic Partners remove the opportunity to connect commercial/research centres and residential areas outside of the city centre. This includes additional Strategic Partner sites.  |
| <b>Minimal visual impact in Cambridge City Centre Conservation Area</b>                                       | With little or no visual impact, a heat network is likely to be the best (and potentially only) way to fully decarbonise Cambridge's many historic Grade I, II* and II Listed Buildings at scale. The alternative of installing at least 48 heat pumps at building level is likely to be extremely difficult due to space, planning, conservation and decarbonisation funding challenges.  |
| <b>Clean air</b>  | Local level heat pump installations will still help deliver clean air by removing fossil fuels at point of use from the city-centre. However, the benefits are likely to be far less, due to the associated deliverability issues.   |
| <b>Strategic added value</b>  | Without CCCHN, Strategic Partners lose the opportunity to develop a Heat Network Digital Twin. For a university city such as Cambridge, which thrives on data, it loses the associated strategic, operational, academic, economic, environmental and social benefits.  |

In addition to strategic risk management, specific attention is drawn to technical and financial due diligence undertaken during DPD.

### 3.6.1.1 Technical Due Diligence

Recognising the world leading academic excellence at the University of Cambridge, Colleges and ARU, as well as the influential role of College Fellows in decision making, an Expert Advisory Group (EAG) for CCCHN was established in Spring 2024. The EAG has provided technical due diligence during Detailed Project Development:

1. **Formed of world-leading academic experts from the University of Cambridge and ARU:** it created the opportunity to use academic expertise to constructively challenge real world consultancy advice, providing clear recommendations, advice and technical assurance for review by the Core Group
2. **Specialist expertise:** in engineering, infrastructure, asset management, energy retrofit, demand side management, power networks, sustainability, land economy, digital innovation and community engagement. It is important that expert insights and views are captured, so that we deliver the best possible project and OBC.
3. **Provides the Strategic Partners and public with extra assurance on the OBC:** helps ensure that we create a 'Best in Class' evidence base for decision makers at the end of DPD. Strategic Partners have the final say through the project's Core Group and Steering Group.

Thank you to all academics that have participated in the group. Cambridge's heat network plans have significantly benefited from EAG input, which has been provided pro bono and ahead of confirmed project viability. EAG's recommendations have enhanced ultimate system performance, customer engagement and commercial viability.

**Table 3—13 Expert Advisory Group, Key Recommendations**

| Date of EAG Meeting  | Main Outcomes   |
|----------------------|---|
| 18 April 2024        | <p>Use a high temperature heat network to maximise the number of connections, noting that the cost and practical constraints of improving the energy performance of so many Grade I, Grade II* and Grade II Listed Buildings</p> <p>Do not just present the project as a degasification strategy. It's not just about cost savings. Even if is slightly more expensive, a heat network might be the preferred option, if it helps Strategic Partners deliver greater carbon savings at scale and reduces their carbon emissions sooner.</p> <p>The carbon benefits need to be highlighted. Even if the heat network is only as cost effective as other options, it may still be beneficial for other reasons, especially in the Cambridge City Centre Conservation Area, where lots of individual heat pumps would be visually intrusive.</p> |
| 3 & 11 February 2025 | <p>Keep an open mind on the heat network solution and an evidence-based approach to test the viability of the proposed CCCHN</p> <p>Ask Bursars to sense check their counterfactuals for each bulk heat supply connection point</p> <p>Ask NWF if it's possible to help fund both the main heat network and on-site secondary heat network upgrades</p> <p>Remove the option for Strategic Partners to become Prosumers and sell heat into the heat network. This is because any waste heat from on-site heat networks wouldn't be able to commercially compete with the heat network supply and its likely lower electricity price.</p>  |
| 12 May 2025          | Maximise thermal storage capacity on the heat network   |

The project's Steering Group has accepted all EAG recommendations, with the heat network team implementing them within the OBC.

### 3.6.1.2 Strategic Engagement to Derisk the City Centre Heat Network

The 21 Strategic Partners are strategically aligned, providing influence in relevant policy, delivery, and geographical areas. Examples of this partnership working strategically together include:

1. **The University of Cambridge convened a thematic meeting of its Special Interest Group on the Built Environment in September 2024 focussed on heat network development:** chaired by Professor Ruchi Choudhary (Chair of the project's Expert Advisory Group), with a Q&A session facilitated by Tim Harvey-Samuel (College heat network project representative, Chair of Bursar's Planning Sub-Committee and Bursar of Trinity Hall). The Panel Session involved Emma Davies (Principal Sustainability Officer, Greater Cambridge Shared Planning), Christian Brady (Head of Conservation, Greater Cambridge Shared Planning) and Venus Tam (Net Zero Associate, UKPN). A series of practical recommendations were made and incorporated into the Economic Case.
2. **Planning Performance Agreement (PPA) for CCCHN:** this has enabled a strategic view and input from statutory consultees on the project's energy centre proposals, which are challenging in the space constrained Cambridge City Centre Conservation Area. Three formal PPA meetings have taken place,
3. **Separate early strategic discussions with statutory and non-statutory consultees:** positive discussions with the Environment Agency; Cambridgeshire County Council (Highways, Archaeology and Local Area Energy Plan); Historic England; Greater Cambridge Shared Planning; Greater Cambridge Partnership (GCP); the Cambridge Archaeological Unit; and UKPN.

This has helped identify and mitigate strategic risks in project development, helping derisk the OBC. The design proposals are nevertheless still at a relatively early stage, with lots of detailed design work needed to develop cohesive designs that positively respond to multiple constraints, to ensure a good fit with Local Planning Policy. For the pipe network, a Local Development Order (LDO) has been deemed inappropriate, as areas of the proposal considered to be more sensitive (such as those close to heritage assets), will need to be responsive to these contexts. This cannot be achieved with an LDO.

4. **Strategic integration of the Cambridge City Centre Heat Network with the Local Area Energy Plan (LAEP):** the heat network team has worked in partnership with the County Council, providing heat network project information to support its development. The aim is for both the OBC and the wider Heat Zoning Study to directly inform and influence the LAEP's conclusions and recommendations, highlighting the need to work closely with UKPN to ensure a strategically coordinated approach to electrical grid upgrades in Cambridge.
5. **The Greater South-East Energy Hub:** funded by the Department of Energy Security and Net Zero (DESNZ), it has provided an independent voice, supporting the Heat Zoning Study by sharing best practice and lessons learned from other UK heat network projects.

### 3.6.1.3 Financial Funding & Due Diligence

In addition to seeking technical due diligence from the Expert Advisory Group, the heat network team has been working closely in partnership with both DESNZ; National Wealth Fund (NWF); Green Heat Network Fund (GHNF); and Green Finance Institute (GFI) to seek independent financial due diligence and support to help overcome project specific challenges:

1. **Strategic engagement and funding from government and its DESNZ team:** An active participant and enabler of the Cambridge City Centre Heat Network project since the start. It has provided £97,680 of grant Heat Network Delivery Unit (HNDU) funding contributions towards both a successful Heat Mapping & Masterplanning Study in May 2023; and a Feasibility Study for the Cambridge City Centre Heat Network in September 2023.  
  
HNDU also funded £167,500 for Detailed Project Development, matched by £720,000 of combined strategic partner contributions to bring forward DPD for the Cambridge City Centre Heat Network. In addition to funding, DESNZ has been a critical friend, attending the project's Core and Steering Group meetings, and actively contributing to the Scopes of Work for both DPD and the parallel Heat Zoning Study for Cambridge. See Appendix G.
2. **Service Level Agreement with National Wealth Fund (NWF):** An NWF funded Service Level Agreement with Cambridge City Council (as lead client), enabling its

heat network team to be a critical friend for CCCHN, offering a unique perspective of lessons learned from other UK heat network projects and associated financing options. NWF has supported Cambridge heat network project development by working to:

- Critique and add value to the DPD Scope of Works.
- Help Strategic Partners consider potential delivery models that best suit our Critical Success Factors, together with commercial implications. This was a complex consideration, which resulted in a uniquely deep engagement for NWF, with attendance at four in person workshops, three online workshops and many pre-meets.
- Support the second Delivery Model Workshop in November 2025, helping Strategic Partners determine the Preferred Delivery Option.
- Informally review both the Commercial and Financial Cases, ahead of a likely NWF low-cost loan application in Q1 2026.
- Support the heat network team with its soft market testing, understanding the pros and cons of market proposals.
- Spreading our Connection Charges: recognising potential difficulty in financing upfront Connection Charges, NWF seeks to address this market failure by providing capital to spread out this cost over up to 10 years, potentially including performance enhancing secondary upgrades. This gives Strategic Partners an alternative payment option.

This product is under development, but could include additional local authority finance, which would be used to convert Partners' Connection Charges into Service Charges, or a NWF private loan facility stapled to a Patient Equity investment

If bundled with a local authority loan, it is likely that a gilts +40bps rate would be used. If a NWF private loan facility, the rate would be significantly higher to reflect commercial rates. In all cases, the loan would be c.10 years, can't exceed asset life / Heat Supply Agreement term & needs to be Subsidy Control compliant.

This independent review and support have been invaluable, helping strengthen the OBC. From NWF's perspective, it has also been a very positive long-term working relationship with the CCCHN project team, which is reflected in its conclusion below:

|   |  |
|---|--|
|  | <p><b>Conclusion</b></p> <p>In NWF's view, CCC has a unique opportunity to develop an ambitious yet commercially viable heat network. The most challenging factor for most networks is securing customer buy-in prior to completion of construction. The demonstrable willingness of educational institutions to commit, which will all have a long-term presence in the city, reduces this risk more than on any other network NWF is supporting.</p> |
|---|--|

3. **Regular meetings with the Green Heat Network Fund's fund managers:**  
 Managed by Triple Point. The heat network team has met several times with Triple Point's Relationship Manager, to maximise strategic alignment. GHNF is a highly competitive process, especially with government's withdrawal of Public Sector Decarbonisation Scheme (PSDS) funding.

**Summary**

This spending proposal benefits from a notable strategic partnership, which has resulted in a strong Minimum Viable Product and appropriate derisking. It fits with national, regional and local policies, strategies and plans.

The Strategic Case also provides the evidence-based case for change, demonstrating that the infrastructure investment delivers all primary and secondary Critical Success Factors agreed with 21 Strategic Partners.

## 4 Economic Case

### 4.1 Purpose

The purpose of the Economic Case is to summarise the available technical options for the Cambridge City Centre Heat Network. It uses an evidence-based assessment to consider the relative benefits and limitations of options and recommend a Preferred Option for implementation. Options are tested against the Strategic Objectives and appraised in line with the site's key characteristics and existing infrastructure, established Critical Success Factors (CSFs) and whole life financial viability parameters, as per the principals of the Green Book methodology.

Network design activities and detailed techno-economic modelling have been carried out to inform the Economic Case. This was an iterative process to optimise the design and operation, whilst minimising the carbon output of the Preferred Option and identifying other technical constraints including phasing and space availability.

The analysis presented in the Economic Case is based on the scheme definition at a point in time and was used to inform the decision making and the development of the Financial Model. The results are constrained by the assumptions made and sensitive to future fluctuations; they should be developed further in subsequent more detailed design stages.

### 4.2 Preferred Option Overview

The Preferred Option can be summarised as a high-temperature (85°C flow / 65°C return) district heating network consisting of three energy centres:

- Parkside Pools energy centre – the primary heat generation location, with 4.6MWth of Air Source Heat Pump (ASHP) and over time, 36MWth of high-voltage electrode boilers (including N+1 resilience) will replace transitional peaking gas boilers
- Midsummer Common energy centre – a satellite heat generation location with 3.5MWth River Source Heat Pump (RSHP) – this high efficiency heat generation will provide baseload supply. This energy centre is accompanied by a pumping station adjacent to the River Cam to enable river water abstraction

- BT Exchange energy centre – a satellite heat generation location with 2.3MWth of ASHP that will support heat generation during the latter phases.

The network will span ~8.2km and provide 73GWh/year of low carbon heating to its 48 connections, [REDACTED]:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

Connection locations have been reviewed through dialogue with Strategic Partners and targeted site visits to maintain accuracy of the technical proposal and de-risk future connection.

A phased build-up of connections across two main phases (Phase 1 2030-32 & Phase 2 2035) is proposed to target alignment with the Strategic Partner decarbonisation goals, allow synchronisation with existing gas boiler replacement dates and provide a realistic development timeframe for infrastructure build-out. This proposed phasing programme is subject to change through the design development programme.

Over the 40-year project life cycle the Preferred Option will enable customers to achieve an estimated 93% carbon emissions reduction versus their Business as Usual gas-driven heating systems.

The proposed network layout and phasing strategy is shown in

Figure 4—1.

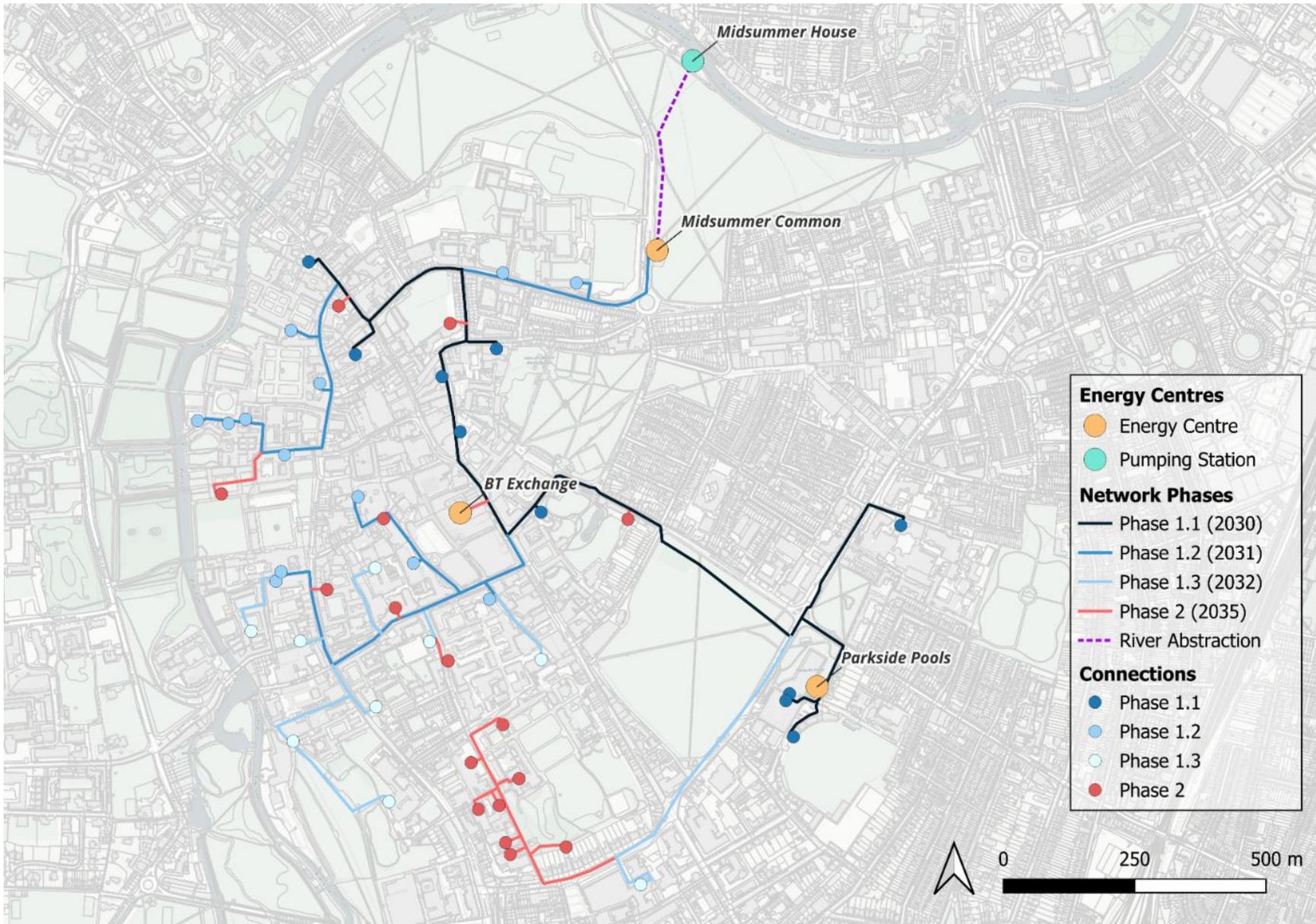


Figure 4—1 Preferred Option network layout & connections

### 4.3 Approach

To arrive at the Preferred Option, a methodology has been adopted based on the principals of Green Book guidance and the following process:

- **Definition of the 'Business as Usual'** i.e. the continued operation of the current energy systems if the proposals under consideration are not implemented. This provides a quantitative benchmark against which to compare carbon savings from the Preferred Option.
- **Definition of the 'Low Carbon Counterfactual'** i.e. the most likely low carbon alternative that customers would progress if the proposals under consideration are not implemented. This provides a quantitative benchmark against which to compare the financial performance of the Preferred Option. This scenario relies on the commitment of customers to decarbonising their energy systems in the future.
- **Longlist of options for new energy network** – based on the feasibility work undertaken in the developmental stages of the project. Includes comparison of network architecture, heat supply options and energy centre locations. Qualitative comparison against the defined CSFs. A shortlist of viable options is output from the assessment.
- **Shortlist of options for new energy network** – shortlisted options are refined and developed to consider key technical and economic factors. Quantitative life-cycle cost comparison and detailed risk assessment.
- **Refinement of Preferred Option** – the Preferred Option is developed in further technical detail, including energy centre and network design and cost and revenues modelling. Quantitative comparison against the Business as Usual (carbon) and Low Carbon Counterfactual (cost) cases. The Preferred Option acts as the basis for further financial analysis in the Financial Case.

### 4.4 Business as Usual

The Business as Usual (BAU) scenario reflects the existing heating systems at the proposed connection locations to act as a baseline for comparison. This scenario has been chosen to best represent the current carbon emissions and the benefits that could be achieved by implementing a new heat network solution. Emission savings of the Preferred Option versus the BAU are presented in Section 4.10.11.3.

The proposed connections fall into two broad categories in terms of existing heating systems:

- **Gas boilers:** For the majority of connections, gas boilers are currently supplying the Space Heating (SH) and Domestic Hot Water (DHW). Heat is supplied at a building or site-wide level depending on the existing heat distribution infrastructure. For boilers installed pre-2020, 80% heat generation efficiency is assumed, otherwise 90% is assumed for newer models.
- **CHP:** In the case where Combined Heat & Power (CHP) generation is present, a 35% heat / electrical generation efficiency is assumed. This case applies to two of the proposed connections only.

### 4.5 Low Carbon Counterfactual

The low carbon counterfactual reflects the most realistic or cost-effective low carbon alternative to decarbonise a connection's heating systems in the case the heat network proposal is not progressed. This scenario is used as a benchmark to determine tariffs and charges for connection to the CCCHN, thereby assessing whether the proposal Preferred Option provides customers with a competitive offer compared to their next-best alternative.

Low carbon counterfactuals have been determined on a case-by-case basis through coordination with Strategic Partners to understand the constraints and opportunities at their sites. They reflect an initial high-level estimation and should be caveated that there is significant uncertainty in their modelled costs, with more detailed design required to de-risk. For details on the low carbon counterfactual modelling and assumptions see Section 4.10.2.

## 4.6 Critical Success Factors

Critical Success Factors are the key attributes on which successful project delivery is dependent. A set of project specific CSFs have been determined for this business case through dialogue with the Strategic Partners, as presented within the Strategic Case. These CSFs are summarised as metrics to measure against in Table 3—7 in Section 3.3. They have been used to assess the long list of potential heating system scenarios, ruling out unsuitable options at an early stage, and are included as part of the benefits/risks appraisals to highlight key differentiators between options.

## 4.7 Longlist Optioneering

The CSFs have been utilised as an instrument to guide decision making throughout the project. The decision-making process has been subject to significant rigour and quantitative analysis carried out where possible. A set of decision gates have facilitated the generation of a single agreed network proposal, which has been tested within techno-economic and financial models. Decision making at each of these gates is presented in the following sections.

### 4.7.1 Options Framework

#### 1. Project Scale:

- Focused selection of connections and timelines based on:
  - Strategic partner decarbonisation ambitions
  - Heat cluster density & demand size
  - Plant replacement strategies
  - Spatial constraints

#### 2. Network Architecture

- Network type (3G/4G/5G/cascade) informed by:
  - Demand grade & scale
  - Decarbonisation & expansion potential

- Spatial availability & utility needs
- Revenue opportunities

#### 3. Generation Technologies

- Comparison of:
  - Low carbon electrified central plant
  - Business-as-usual (gas boilers)
  - Building-level low carbon alternatives

#### 4. Energy Centre Locations

- Assessed based on:
  - Timing & proximity of connections
  - Space availability
  - Ownership status

#### 5. Preferred Option Selection

- Integrated assessment of:
  - Network architecture
  - Generation technologies
  - Energy centre locations
  - Economic viability

#### 6. Economic Appraisal

- Cashflow analysis for feasibility
- Comparison with low carbon counterfactual

## 4.7.2 Project Scale

### 4.7.2.1 Load Assessment

This section outlines the approach to estimating heating loads for potential connections as part of the Minimum Viable Product (MVP). An initial demand assessment was carried out as based on information gathered through Requests for Information (RFIs) issued to the Strategic Partners. This data has formed the basis of the longlist-shortlisting appraisal. Data sources are summarised in Table 4—1.

**Table 4—1 Heating demand data sources**

| Strategic Partner        | Data Source – Annual Heat   | Data Source – Peak Heat   |
|--------------------------|---|---|
| Colleges                 | Monthly metered gas invoice data (2021-2023) for each College as shared by College Sustainability Committee.  | Existing gas boiler capacities, as reported in RFIs and later validated on site visits.   |
| University of Cambridge  | Where available, metered half-hourly (HH) gas consumption data shared for each building. For buildings without HH gas consumption data, annual gas consumption estimates provided by stakeholders as based on historical estimates / energy strategy reports. | Where available, metered half-hourly (HH) gas consumption data shared for each building. For buildings without HH gas consumption data, estimations from the university based on historic data. |
| Anglia Ruskin University | Metered half-hourly (HH) gas consumption data shared for each building.   | Metered half-hourly (HH) gas consumption data shared for each building.   |
| Cambridge City Council   | Max Fordham Decarbonisation Study and previous AECOM Heat Network Feasibility Study.  | Max Fordham Decarbonisation Study and previous AECOM Heat Network Feasibility Study.  |
| Other                    | Several other organisations [REDACTED] have provided data and expressed interest in the project. These loads beyond the Strategic Partners are not incorporated into the MVP  |   |

Having established the portfolio of Strategic Partner heat loads across Cambridge City Centre, an MVP Customer Connection Decision Tree was developed in conjunction with the client team to identify a set of heat loads most suitable for near term heat network connection, thereby prioritising these for inclusion as part of the Minimum Viable Product. The MVP Decision Tree is based on geospatial analysis of loads, prioritisation of larger loads

which are likely to most economical to connect (and benefit the most from the carbon reduction impact) and where possible clustering of neighbouring loads to aggregate demand and simplify the connection strategy. The process flow is shown in Figure 4—2. The MVP Decision Tree is based on geospatial analysis of loads, prioritisation of larger loads which are likely to most economical to connect (and benefit the most from the carbon reduction impact) and where possible clustering of neighbouring loads to aggregate demand and simplify the connection strategy. The MVP Decision Tree is based on geospatial analysis of loads, prioritisation of larger loads which are likely to most economical to connect (and benefit the most from the carbon reduction impact) and where possible clustering of neighbouring loads to aggregate demand and simplify the connection strategy.

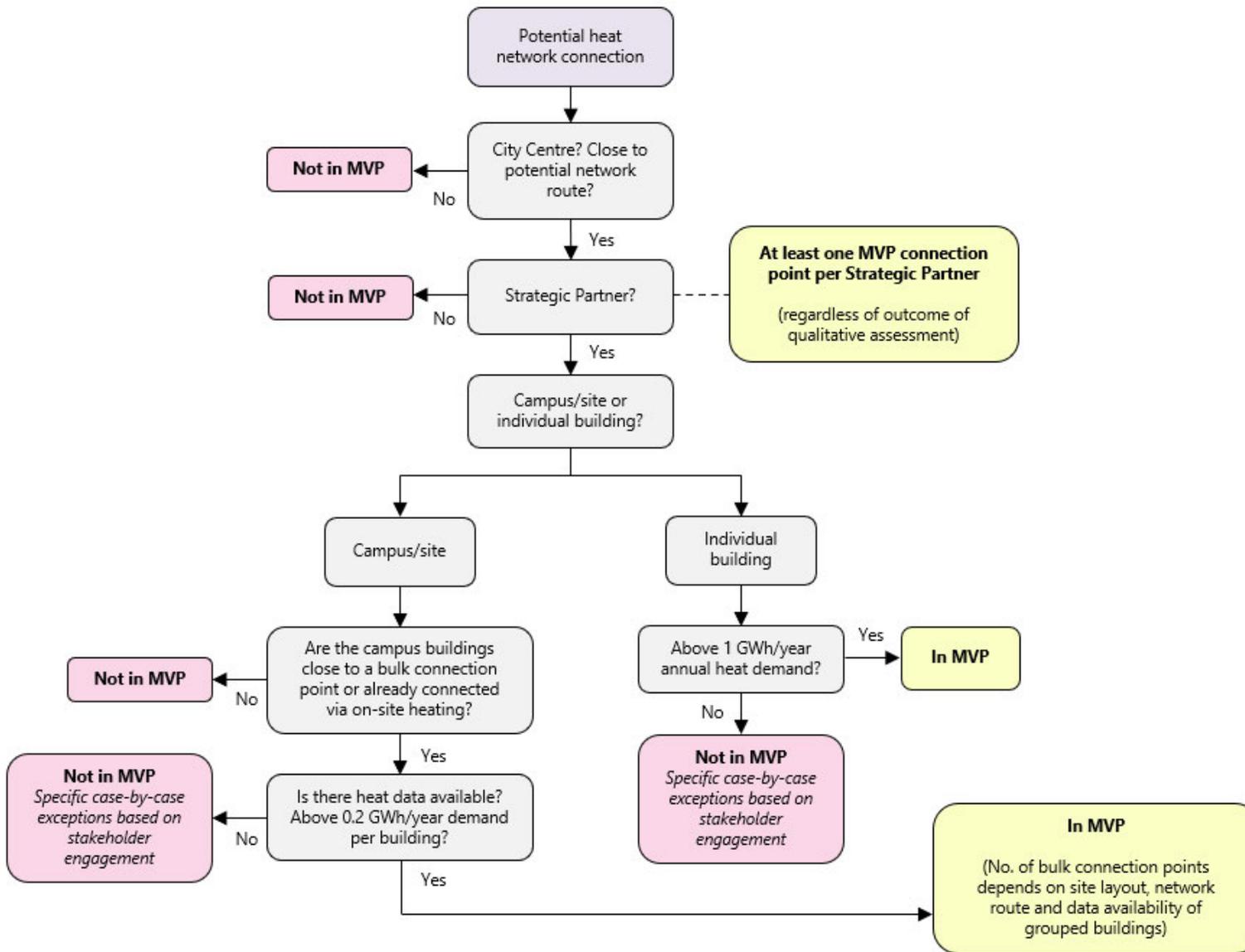


Figure 4—2 MVP Customer Connections Decision Tree

Following the MVP Customer Connection Decision Tree process, is shown in Figure 4—2. When assessing the heat loads, only demands >200MWh/year are included, noting connection of smaller loads is likely to be detrimental to the business case. The presented demand data is aggregated to protect Strategic Partner confidentiality agreements. Of the 66 potential customer connections assessed, 34 were proposed for inclusion as part of the initial MVP. This ~50% of the identified Strategic Partner connections represent 80% of the modelled heat load.

**Table 4—2 Strategic Partner and proposed longlist stage MVP heat loads**

| Parameter                      | Unit     | Strategic Partners | Longlisting stage - Minimum Viable Product |
|--------------------------------|----------|--------------------|--|
| Number of connections          | -        | 66                 | 34   |
| Total annual heat demand       | GWh/year | 85                 | 68   |
| Undiversified peak heat demand | MW       | 44                 | 37   |

It should be noted that whilst at this stage the initial demand assessment has been utilised for heat network option development, at the Preferred Option stage the demand assessment was refined further following site visits to each potential College connection and additional University of Cambridge / Anglia Ruskin University sites and a more detailed data gathering exercise. The outcomes of this refined Preferred Option load assessment are provided later in Section 4.9.1, and supersedes the loads presented above in Table 4—2 and in this optioneering stage.

#### 4.7.2.2 Future Demand

For the purposes of the baseline modelling in this business case, it is assumed that heat demand will remain constant over the project life. Whilst it is anticipated that the Strategic Partners will undergo retrofit / building efficiency projects over the coming years at many of the proposed connections, at this stage the timeline, scope and impact of such interventions is uncertain and therefore challenging to quantify. It is proposed that potential reductions in future heating demand are assessed in the sensitivity analysis in Section 4.10.12 rather than

included in the base-case. Excess heat availability in the network due to any retrofit provides opportunity to extend the network to further customers to backfill demand and keep it constant.

#### 4.7.2.3 Future Weather Conditions

It is expected that climate change will impact future space heating demands. Demand reduction over time due to anticipated increasing temperature conditions is not included in the baseline model, however, is assessed considering heating degree days (HDD) in the sensitivity analysis in Section 4.10.12.

#### 4.7.2.4 Cooling Loads

Based on the RFI returns, limited cooling demand is understood to exist across the majority of stakeholders and where cooling is utilised limited in-use data is available. Cooling electrical consumption is generally not metered separately to general building consumption and therefore it is difficult to disaggregate the cooling load. Where there was found to be cooling, these were typically (but not exclusively) smaller local-scale cooling plant (<250kWth) distributed across the city at point-of-use.

The limited available cooling data indicates that the City Centre-wide consumption is generally low, with the exceptions being university labs / clinical buildings. For this reason, the potential for a combined heating and cooling network is low. Future expansion opportunities and interface with wider stakeholder groups (e.g. large commercial/retail spaces) may offer opportunity for integration of waste heat into the proposed network – this is viewed as an opportunity beyond the initial MVP proposal.

Many connections also have mostly smaller local-scale cooling plant distributed across the site at point-of-use.

### 4.7.3 Network Architecture

A traditional heat network distributes heat from a central energy centre(s) at temperatures that could be directly utilised for space heating and domestic hot water within connection buildings. Traditional heat network architecture options have been investigated for incorporation in the CCCHN:

- **High temperature (85/65°C flow/return temperatures)** - A traditional high temperature heat network distributes heat from a central energy centre(s) at temperatures that could be directly utilised for space heating and domestic hot water within connection buildings
- **Cascade system (55/35°C flow/return temperatures)** – A cascade network distributes at a lower temperature that would not be able to be directly utilised for space heating and domestic hot water within most connection buildings, however, would enable centralised heat to be generated at higher efficiencies. Whilst some connection buildings may be able to directly utilise the cascade system without further top-up, for buildings that require higher temperatures a local Water Source Heat Pump (WSHP) would be required to provide a ‘cascade’ uplift.
- **Ambient loop (25/10°C flow/return temperatures)** – Ambient loop networks are most suitable for networks with a balanced heating / cooling load or where a waste heat source can be utilised. In these systems heat is distributed at ambient temperatures and uplifted by local WSHPs at connections. This network has the benefit of being able to provide both heating and cooling generation at connections via a single two-pipe loop.
- **Cooling network (6/12°C flow/return temperatures)** – A two-pipe district cooling network could run parallel to the high temperature and cascade systems noted above, forming in total a four-pipe system, delivering coolth to end user customers from the central energy centre(s) in a similar (but inversed) manner to traditional heat networks.

Table 4—3 sets out the decision matrix for the proposed architecture, with a high temperature network (excluding cooling) the preferred configuration. In the case of the Cambridge City Centre, the building stock is for the most part old, poorly insulated and often of listed status. As such, most building heating systems require heat supply at 70-80°C. In the case of the CCCHN a traditional two-pipe **high temperature heat network is proposed** with heat distribution at ~85/65°C flow/return temperatures.

The ambition will be to reduce temperatures over time across connections – many proposed connections are known to operate weather compensation and for most of the year are operating at lower flow temperatures such as 60°C. The medium-term ambition would be to get all systems to operate on this basis to reduce temperatures for most of year – varying network temperatures through the year to minimise losses and maximise plant efficiency. In the long-term, as Strategic Partners go through building retrofit cycles, there may be opportunity for network temperatures to be reduced even in winter, reducing operating costs and therefore heat tariffs to customers.

For further detail of the network architecture appraisal, see Appendix J.

Table 4—3 Network architecture appraisal matrix

| Network architecture            | Decarbonisation potential | Capital cost | Operational cost | Technology risk | Security of supply | Local environmental impact | Space and works required | Compatibility with cooling | Taken forward?   |
|---------------------------------|---------------------------|--------------|------------------|-----------------|--------------------|----------------------------|--------------------------|----------------------------|--|
| <b>High temperature network</b> | High                      | Medium       | Medium           | Low             | High               | Low                        | Medium                   | Low                        | Yes – option best suited to Cambridge building stock and existing secondary heating system temperatures. Medium capital investment required, but least space intensive option at connections. Potential opportunity to decrease temperatures and improve efficiencies in the future as connections retrofit, although this would require aligned thinking. |
| <b>Cascade system</b>           | High                      | High         | Medium           | High            | Medium             | Low                        | High                     | Low                        | No – demand assessment indicates the majority of connections require higher temperatures, therefore significant investment in cascade heat pumps and ancillaries would be required, This is both a capex and spatial risk.   |
| <b>Ambient loop</b>             | High                      | High         | High             | High            | Low                | Low                        | High                     | High                       | No – modelling indicates limited balance between heating and cooling loads and a lack of suitable waste heat sources. High capital and operational costs as well as spatial requirements are unlikely to make this option technically or economically feasible.  |
| <b>Cooling network</b>          | Low                       | High         | Medium           | Low             | High               | Low                        | High                     | N/A                        | No – limited cooling loads suggest poor payback on the infrastructure investment required to deliver a cooling network. Decentralised solutions are likely better value for money.   |

#### 4.7.4 Heat Generation Technologies

Several heating technologies could realistically be deployed to serve the CCCHN, as summarised in the heat generation technology appraisal matrix Table 4—4. In alignment with the CSFs, the key characteristics prioritised for the CCCHN are decarbonisation potential, economic impact and reliability. Based on the technology assessment, several options represent clear candidates for progression to the shortlist stage:

Primary heat generation:

- **Air-source heat pumps (ASHP)** – widely available heat source, capable of generating low carbon heat at fairly high efficiencies. Primary constraint is space intensity and acoustic/visual impact.
- **River-source heat pumps (RSHP)** – high efficiency low carbon heat generation, however output constrained by the available abstraction flow rate of the River Cam. Proximity requirement limits energy centre location options.

Peaking / resilience heat generation:

- **Electric boilers** – low carbon peaking heat generation option. Less capital intensive than heat pumps. Expensive to operate, therefore prioritised for peaking support only.
- Gas boilers to be explored as part of the sensitivity analysis. *Ultimately the economic performance of a top-up gas boiler transitional scenario (replacement with electric boilers at end of 15-year expected life) was re-baselined as the Preferred Option following sensitivity analysis.*

For further detail of the heat generation technologies appraisal, see Appendix K.

Note the heat generation technology appraisal should be caveated that the recommendations are in the context of CCCHN only – it may still be the case that technologies that are not recommended for a heat network are still viable locally as counterfactual options at a building or site-wide level.

Table 4—4 Heat generation technology appraisal matrix

| Generation technology                 | Resource availability / seasonality | Decarbonisation potential | Capital cost | Operational cost | Modularity / scalability | Commercial complexity & technology risk | Local environmental impact | Spatial requirements | Planning considerations & consents | Taken forward?  |
|---------------------------------------|-------------------------------------|---------------------------|--------------|------------------|--------------------------|---|----------------------------|----------------------|------------------------------------|---|
| Air Source Heat Pump                  | Medium                              | High                      | Medium       | Medium           | High                     | Low                                     | Medium                     | High                 | Medium                             | Yes – widely available, scalable heat source. Limited by space availability and air-flow access.  |
| Ground Source Heat Pump – Open Loop   | Low                                 | High                      | High         | Low              | Low                      | Medium                                  | Medium                     | Low                  | Medium                             | No – unsuitable groundwater conditions for a large-scale heat network. Limited yield available.   |
| Ground Source Heat Pump – Closed Loop | Medium                              | High                      | High         | Medium           | Medium                   | Medium                                  | Low                        | High                 | High                               | No – lack of balanced heating/cooling loads will lead to ground temperature depletion over time, particularly at the scale of heat extraction required for a large heat network. Scale of borehole array required likely infeasible in terms of capex and installation rate. Thermal conductivity in local area is considered average-poor.<br><br>Note this does not preclude individual heat consumers from developing smaller-scale local GSHP solutions which have better synergy with their heat consumption requirements. |
| Deep Geothermal                       | Low                                 | High                      | High         | Low              | Low                      | High                                    | Low                        | Medium               | Medium                             | No - unsuitable geological conditions.  |
| River Source Heat Pump                | Medium                              | High                      | High         | Low              | Medium                   | Medium                                  | Low                        | Medium               | Medium                             | Yes – River Cam provides opportunity for high efficiency low carbon heat generation. Limited by abstraction flow rate permitted by the Environment Agency.  |
| Data Centre Heat Recovery             | Low                                 | High                      | Medium       | Low              | Low                      | High                                    | Low                        | Medium               | Low                                | No - no suitable existing data centre locations in/close to the city centre. However, this option should be reviewed in the future as data centre deployment potentially ramps up in the local area.  |
| Chiller Heat Recovery                 | Low                                 | High                      | Medium       | Low              | Medium                   | Medium                                  | Low                        | High                 | Low                                | No - limited large-scale chiller installations, poor seasonal synergy. Deliverability likely complicated by space availability and commercial arrangements.   |

| Generation technology | Resource availability / seasonality | Decarbonisation potential | Capital cost | Operational cost | Modularity / scalability | Commercial complexity & technology risk | Local environmental impact | Spatial requirements | Planning considerations & consents | Taken forward?   |
|-----------------------|-------------------------------------|---------------------------|--------------|------------------|--------------------------|---|----------------------------|----------------------|------------------------------------|--|
| Sewer Heat Recovery   | Low                                 | High                      | High         | Low              | Low                      | High                                    | Low                        | Medium               | Low                                | No - unsuitable sewer dimensions, limited information available.   |
| Solar Thermal         | Low                                 | High                      | Medium       | Low              | Medium                   | Low                                     | Low                        | High                 | Medium                             | No – limited roof space availability, particularly at the scales required to supply a large heat network. Poor seasonal synergy.   |
| Solar PV              | Low                                 | High                      | High         | Low              | Medium                   | Low                                     | Low                        | High                 | Medium                             | No – limited roof space availability, poor seasonal synergy. High costs at scale required to make meaningful impact.   |
| Gas Boilers           | High                                | Low                       | Low          | Low              | High                     | Low                                     | High                       | Low                  | Medium                             | To be reviewed in sensitivity analysis – Preferred not to install new gas boilers, however they are typically more economical than the electric alternative, so may be required for project viability. Adoption of existing could provide transitional support to renewable heat generation. Note gas boilers could be adjusted to burn pure hydrogen in the future with new burners.<br><br>Update post-sensitivity analysis/financial modelling – gas boilers to be incorporated in revised Preferred Option due to benefits as a transitional technology. |
| Electric Boilers      | Medium                              | High                      | Medium       | High             | Medium                   | Medium                                  | Low                        | Low                  | Low                                | Yes – long-term solution to heat generation top-up / back-up. Limited by grid electrical supply and high operational costs.  |
| Hydrogen Boilers      | Low                                 | Medium                    | Low          | High             | High                     | High                                    | Low                        | Low                  | Low                                | No – lack of certainty in future hydrogen availability. Currently operational cost prohibitive.  |

#### 4.7.5 Energy Centre Locations

A longlist of Energy Centre (EC) locations was developed based on discussions with the Core Group and RFI responses, shown in Figure 4—3. These locations have been assessed in line with the CSFs and Strategic Objectives.

The energy centre appraisal matrix is shown in Table 4—5. For brevity, only locations with at least an amber RAG rating are presented in this report. The assessment of the potential locations resulted in five opportunities to be taken forward to shortlist stage. These are the locations with the most realistic potential for development for the MVP, limiting deliverability risk:

- Parkside Pool/Kelsey Kerridge Sports Centre (one combined site)
- Midsummer Common toilet block
- [REDACTED]
- [REDACTED]
- Jesus Lock (later discounted)
- Midsummer House (as a potential RSHP abstraction pumping station).

Two additional options remain open as consideration for further upside at the Commercialisation stage of the project. These are:

- The Guildhall (to confirm whether space from the redevelopment can be set aside and used for the CCC DHN) – however it is anticipated that capacity will not be substantial in this location once considering planning limitations
- [REDACTED] this space was identified late in the DPD process but could have upsides due to proximity to river and the Colleges, notwithstanding some known constraints (in particular ecological considerations).

[REDACTED]

For a more detailed breakdown of the energy centre locations assessment process see Appendix L.

Table 4—5 Energy Centre Appraisal Matrix

| Location                      | Site details  | Ownership / Lease status | Spatial availability | Planning risk | Local receptors | Local heat source availability | Proximity to heat connections | Power capacity | Development status risk | Taken forward?   |
|-------------------------------|---|--------------------------|----------------------|---------------|-----------------|--------------------------------|-------------------------------|----------------|-------------------------|--|
| Parkside Pools                | Car parking area to the rear of the swimming pool. Possible option to extend utilized footprint on to grassy strip running along rear of building.                        | CCC                      | Medium               | High          | Medium          | High                           | Medium                        | Medium         | Low                     | Yes – reasonable space availability for plant and ASHPs, proximity to expected network route. Ownership within CCC jurisdiction. Adjacent to Kelsey Kerridge rooftop for additional capacity potential<br><br>Sensitive area from a conservation standpoint. |
| Kelsey Kerridge Sports Centre | Rooftop space above the sports centre and potential access to an unused rooftop plantroom. Site likely to go through redevelopment in coming years.                       | CCC                      | Medium               | Medium        | Low             | High                           | Medium                        | Medium         | Medium                  | Yes – potential to provide space for additional heating plant capacity to support an energy centre located at Parkside Pools.  |
| [REDACTED]                    | [REDACTED]  | CCC                      | Medium               | Medium        | Medium          | High                           | Medium                        | Medium         | High                    | [REDACTED]   |
| Midsummer Common Toilet Block | Existing toilet block – opportunity for demolition and replacement with new energy centre. Constrained by 200m <sup>2</sup> footprint limit for building on commons land. | CCC                      | Low                  | High          | Low             | High                           | High                          | Medium         | Low                     | Yes – strong opportunity for heat abstraction from the nearby River Cam, enabling high efficiency WSHP heat generation.<br><br>High planning risk due to public location and conservation area. High design risk due to spatial limitations.                 |
| Guildhall                     | One of a number of buildings within the ongoing Civic Quarter redevelopment.  | CCC                      | Low                  | Medium        | High            | Low                            | High                          | Medium         | Medium                  | No - limited opportunity due to spatial constraints, sensitive area and current redevelopment timelines.   |
| [REDACTED]                    | [REDACTED]  | CCC                      | High                 | Low           | Low             | Medium                         | Low                           | Medium         | Medium                  | [REDACTED]   |
| [REDACTED]                    | [REDACTED]  | CCC                      | Low                  | High          | High            | High                           | Low                           | Medium         | Low                     | [REDACTED]   |

| Location        | Site details  | Ownership / Lease status | Spatial availability | Planning risk | Local receptors | Local heat source availability | Proximity to heat connections | Power capacity | Development status risk | Taken forward?   |
|-----------------|---|--------------------------|----------------------|---------------|-----------------|--------------------------------|-------------------------------|----------------|-------------------------|--|
| [REDACTED]      | [REDACTED]  | [REDACTED]               | [REDACTED]           | [REDACTED]    | [REDACTED]      | [REDACTED]                     | [REDACTED]                    | [REDACTED]     | [REDACTED]              | [REDACTED]   |
| [REDACTED]      | [REDACTED]  | [REDACTED]               | [REDACTED]           | [REDACTED]    | [REDACTED]      | [REDACTED]                     | [REDACTED]                    | [REDACTED]     | [REDACTED]              | [REDACTED]   |
| [REDACTED]      | [REDACTED]  | [REDACTED]               | [REDACTED]           | [REDACTED]    | [REDACTED]      | [REDACTED]                     | [REDACTED]                    | [REDACTED]     | [REDACTED]              | [REDACTED]   |
| [REDACTED]      | [REDACTED]  | [REDACTED]               | [REDACTED]           | [REDACTED]    | [REDACTED]      | [REDACTED]                     | [REDACTED]                    | [REDACTED]     | [REDACTED]              | [REDACTED]   |
| [REDACTED]      | [REDACTED]  | [REDACTED]               | [REDACTED]           | [REDACTED]    | [REDACTED]      | [REDACTED]                     | [REDACTED]                    | [REDACTED]     | [REDACTED]              | [REDACTED]   |
| [REDACTED]      | [REDACTED]  | [REDACTED]               | [REDACTED]           | [REDACTED]    | [REDACTED]      | [REDACTED]                     | [REDACTED]                    | [REDACTED]     | [REDACTED]              | [REDACTED]   |
| Midsummer House | CCC owned plot of unused land adjacent to Midsummer House Restaurant. | CCC                      | Low                  | Medium        | Low             | High                           | Medium                        | Medium         | Low                     | Progressed for consideration as a RSHP pumping station only – insufficient space for heat generation, however proximity to river is strong opportunity for heat abstraction. |

#### 4.7.6 Longlisting Outcomes

The review of the longlist of heat and cooling demands, technology options, and network configurations led to a refined shortlist of viable options. This process was shaped by the overarching requirement to connect all Strategic Partners where feasible, alongside the need to define a minimum viable product that was both deliverable and lower risk. These criteria significantly constrained the number of feasible options at the shortlisting stage, particularly in relation to the location and potential capacities of the energy centres. Due to the limited range of viable options, the options longlist has been directly fed into the shortlist for further detailed appraisal.

Following workshops with the Strategic Partners and stakeholders, the resulting MVP options were proposed for shortlist:

Network Temperature: High temperature (85/65°C flow/return) heat network.

Two variations of the MVP were shortlisted for further testing and techno-economic modelling, with the heat pump generation supported by peaking electric boilers in each case:

1. ASHP & RSHP
2. ASHP only (assuming space for an extra energy centre can be found).

## 4.8 Shortlist Optioneering

The purpose of the DPD shortlisting stage is to carry out a quantitative analysis on the shortlist of viable heat network options to inform an initial comparison of the techno-economic performances, thus enabling a Preferred Option to be determined and progressed to more detailed RIBA Stage 2 design. As such, the shortlisted scenarios do not necessarily reflect the final proposed network design, but rather simplified designs that enable an emphasis on analysing the advantages and disadvantages between options.

### 4.8.1 Shortlisted Options

Following the longlisting appraisal process, two heat network options were proposed for progression to shortlisting stage as based on a qualitative assessment of their technical feasibility and alignment with the project CSFs. Each of these options represents an alternative heat generation technology mix to deliver decarbonisation to the MVP connections.

- **Option 0 – Do Nothing** – continued operation of the fossil-fuel driven Business as Usual heating systems, for carbon comparison purposes only
- **Option 1 – Desirable Solution** – high temperature city-centre wide heat network with RSHP & ASHP heat generation
- **Option 2 – Alternative Option** – high temperature city-centre wide heat network with ASHP heat generation only.

Both Option 1 and Option 2 are projected to serve MVP connections totalling 69GWh/year (noting this heat demand is revised post- shortlist stage) of the overall potential 91GWh/year heat demand identified during the initial demand assessment stage.

The modelling carried out at this shortlist stage is indicative only, with specific network connections and demands revised in the Preferred Option analysis through further refinement of the scheme Section 4.9. In each case, heat pumps have been sized to target 90% total annual heat fraction, whilst top-up heat generation will be supplied boilers; at this shortlisting stage full electric boiler top-up is assumed, however incorporation of gas boilers will be investigated as part of the sensitivity analysis in Section 4.10.12.

Following discussion with the Strategic Partners regarding the potential Option 1 energy centre locations, it was proposed that several ‘sub-options’ of Option 1 be reviewed to understand the technical, economic and risk impacts of progressing each option. As such Option 1 is split into a further four sub-options, as summarised in the following table.

**Table 4—6 Shortlisted Options**

| Option | Heat pump technologies | ASHP energy centre locations | RSHP energy centre locations | Abstraction pumphouse location                   |
|--------|------------------------|------------------------------|------------------------------|--|
| 1.1    | RSHP + ASHP            | Parkside Pools + BT Exchange | Midsummer Common             | Midsummer Common / River Cam bank (Underground)  |
| 1.2    | RSHP + ASHP            |                              | Midsummer Common             | Midsummer Common / River Cam bank (Above-ground) |
| 1.3    | RSHP + ASHP            |                              | Jesus Lock                   |  |
| 1.4    | RSHP + ASHP            |                              | Riverside Car Park           | Riverside Car Pak / River Cam bank (Underground) |
| 2      | ASHP                   |                              | N/a                          |  |

### 4.8.1.1 Option 1 – RSHP & ASHP

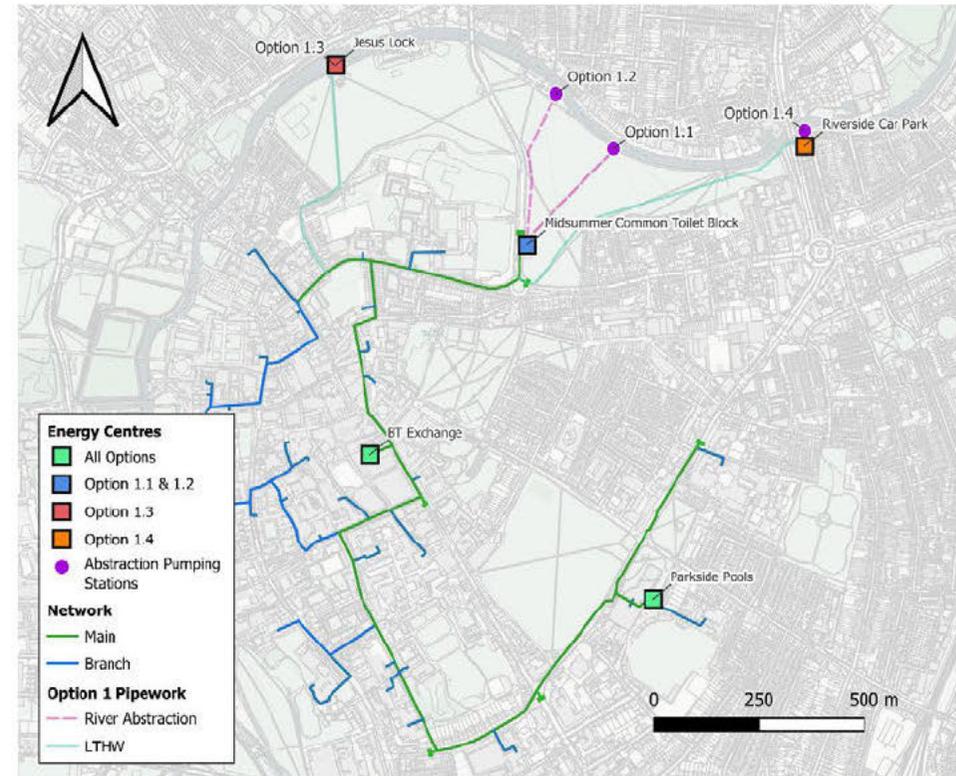
Shortlist Option 1 consists of four sub-options with alternative RSHP energy centre/pumping station locations, as shown in Figure 4—4. This option includes 10.4MW total heat pump capacity, with peaking/back-up boiler capacity located at Parkside Pools, and 6.5-7.3km of buried network.

A high-level technical configuration sketch for Option 1 is shown in Figure 4—6. Note this is a simplified single-energy centre diagram, and in practice multiple satellite energy centres will be required for each solution. Note also depending on the river abstraction location, Option 1 may have a separate abstraction pumphouse or it may be incorporated within the energy centre design.

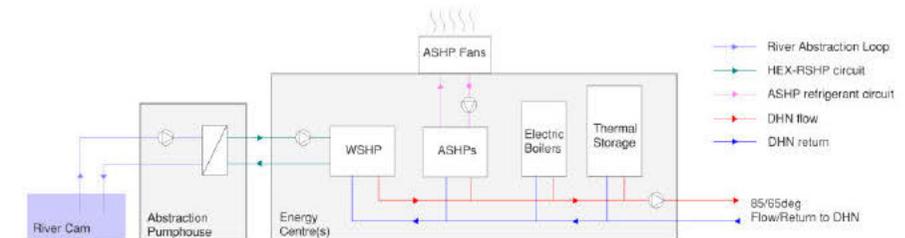
It should be noted that when assessing Option 1.3 a small hydropower solution is included at Jesus Lock as per recommendation from the Client.

**Table 4—7 Shortlist Option 1 - energy centre locations and heating plant capacities**

| Option | ASHP energy centres              | ASHP / Electric boiler heating plant capacity                                       | RSHP energy centres | RSHP heating plant capacity | RSHP abstraction location                           |
|--------|----------------------------------|---|---------------------|-----------------------------|---|
| 1.1    | Parkside Pool<br><br>BT Exchange | Parkside Pool – 4.6MW ASHP + 36MW electric boilers<br><br>BT Exchange – 2.3 MW ASHP | Midsummer Common    | 3.5MW RSHP                  | Underground pumphouse downstream of Midsummer House |
| 1.2    |                                  |   | Midsummer Common    |                             | Above ground pumphouse adjacent to Midsummer House  |
| 1.3    | Jesus Lock                       | Within energy centre at Jesus Lock  |                     |                             |   |
| 1.4    | Riverside Car Park               | Underground pumphouse next to Elizabeth Way   |                     |                             |   |



**Figure 4—4 – Option 1 network layout**



**Figure 4—5 Option 1 technical configurations**

#### 4.8.1.2 Option 2 – ASHP Only

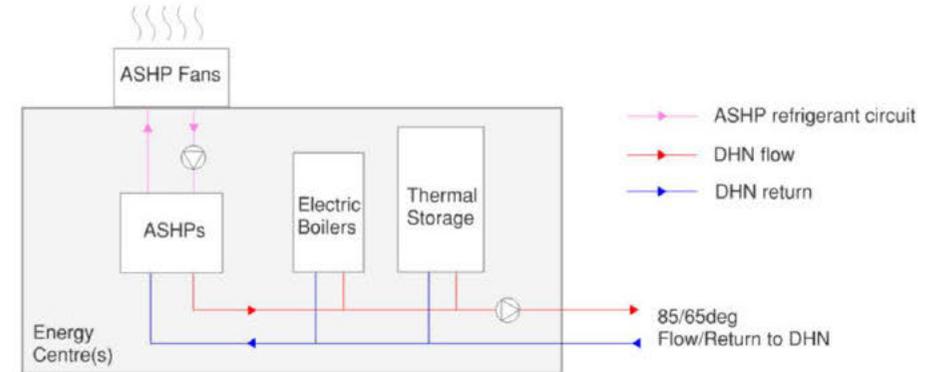
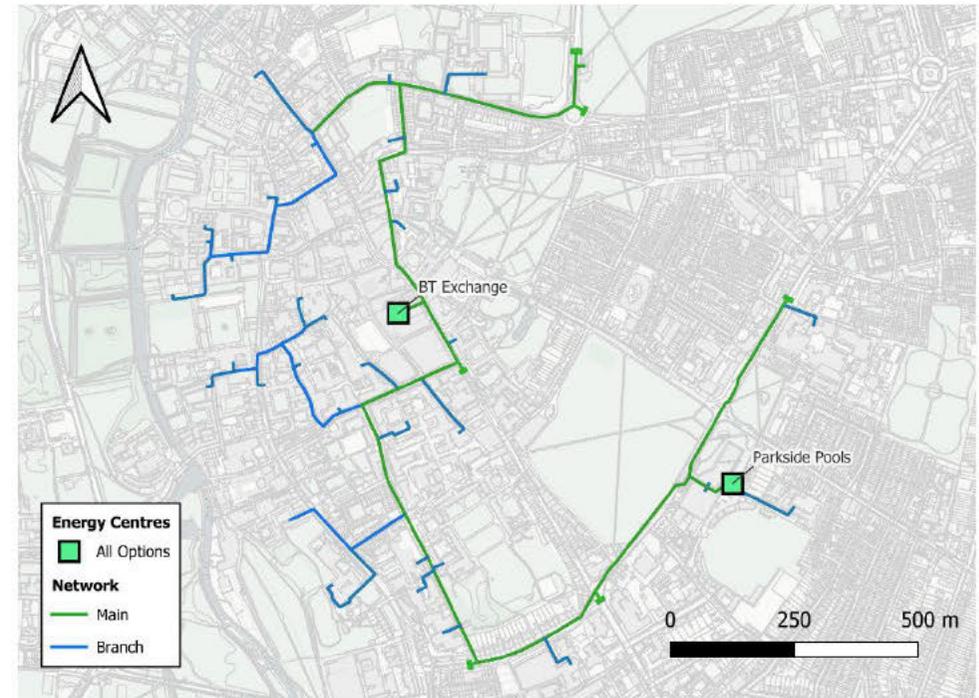
Shortlist Option 2 consists of only two ASHP driven energy centres as shown in Figure 4—. This option includes 9.0MW total heat pump capacity, with peaking/back-up boiler capacity located at Parkside Pools, and 6.1km of buried network.

A high-level technical configuration sketch for Option 2 shown in Figure 4—7. Note this is a simplified single-energy centre diagram, and in practice multiple satellite energy centres will be required.

The Option 2 proposal assumes that the additional ASHP capacity required for the network to reach 90% heat pump heat fraction can be accommodated at Parkside Pools and BT Exchange, noting the spatial, commercial and planning constraints at each introduce a high risk to project feasibility. Alternative energy centres suitable for ASHP heat generation have not been identified at this stage.

**Table 4—8 Option 2 energy centre locations and heating plant capacities**

| Energy Centre | Heating Plant                      |
|---------------|------------------------------------|
| Parkside Pool | 5.7MW ASHP<br>36MW Electric Boiler |
| BT Exchange   | 3.3MW ASHP                         |



**Figure 4—7 Option 2 technical configuration**

## 4.8.2 Shortlist – Economic Appraisal

A whole-lifecycle approach to economic appraisal of the shortlisted options has been taken as an alternative to a full cashflow model. This was based on the understanding that the purpose of the shortlisting stage is to determine the most cost-effective heat network option to be carried forward for more detailed modelling. Given that in each of the shortlisted options the proposed connections and revenues are equivalent, a comparative cost model provides sufficient information to make this selection. Revenue streams were incorporated at Preferred Option assessment stage following further detailed engagement with Strategic Partners to understand their most-likely low carbon counterfactuals, see Section 0.

Inputs to the shortlisting economic appraisal are in general built on benchmarked data, industry guidance and previous project experience. Costs in the subsequent Preferred Option analysis make use of market quotes with input from cost consultant specialists.

### 4.8.2.1 Key Assumptions

Key modelling assumptions:

- 40-year project lifetime
- Costs modelled in real 2025 values (CPI used to inflate from previous projects where necessary)
- Costs discounted across project lifetime in line with Green Book guidance
- Heat network operation from 2030-2070
- During shortlisting modelling only, network modelled in a single phase.

For a detailed breakdown of inputs, assumptions, exclusions and results see the accompanying Technical Feasibility Report.

### 4.8.2.2 Whole Life-cycle Costs

Results from the whole life-cycle cost model comparison are shown in the following table and

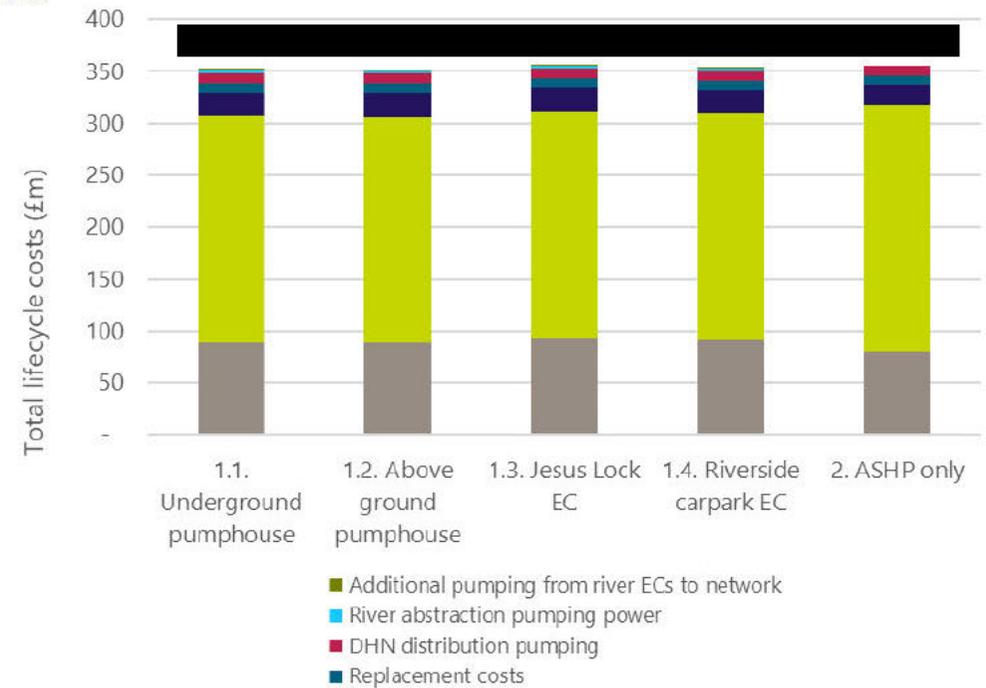
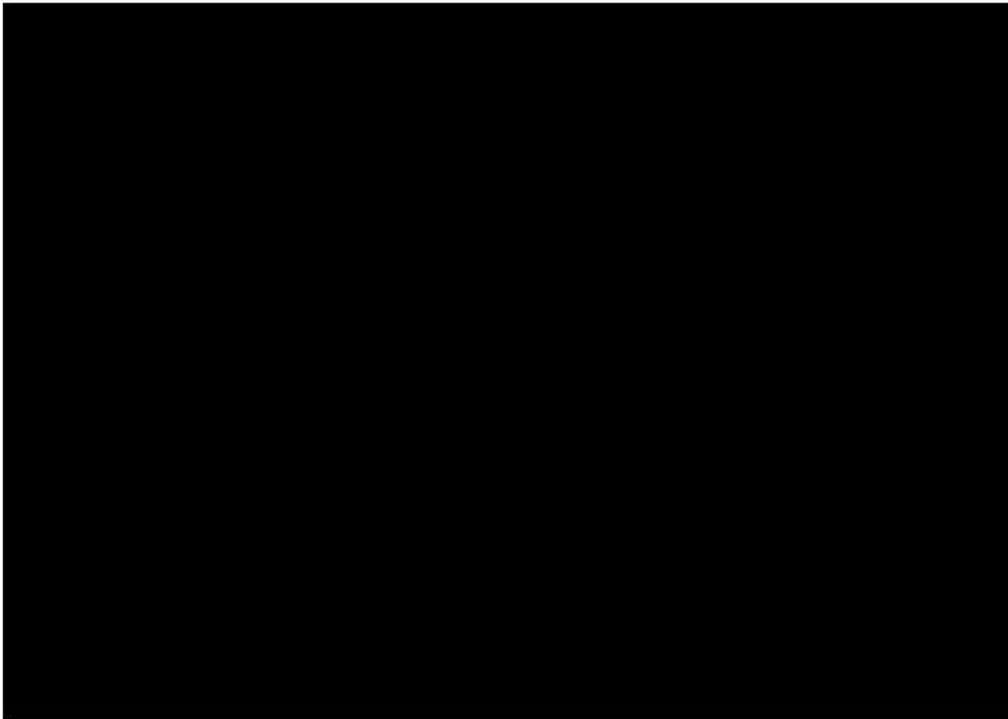


Figure 4—8. Note the presented costs are undiscounted.

| [Redacted] |            |            |            |            |            |
|------------|------------|------------|------------|------------|------------|
| [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] |
| [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] | [Redacted] |





The shortlisted scenarios have also been compared in the context of Levelised Cost of Heat (LCOH) - LCOH is the cost per unit of useful heat delivered (p/kWh), including CapEx, OpEx & RepEx over the 40-year Business Plan. As the LCOH includes the discounting rate applied across project cashflows, it can offer a more contextualised method of comparison than just the whole life-cycle costs analysis. LCOH results for each of the shortlisted options are provided in Table 4—10.

When considering LCOH, Option 2 performs marginally better than Option 1 scenarios due to the shifting of capital costs into operational costs that are spread across the entire project life cycle.

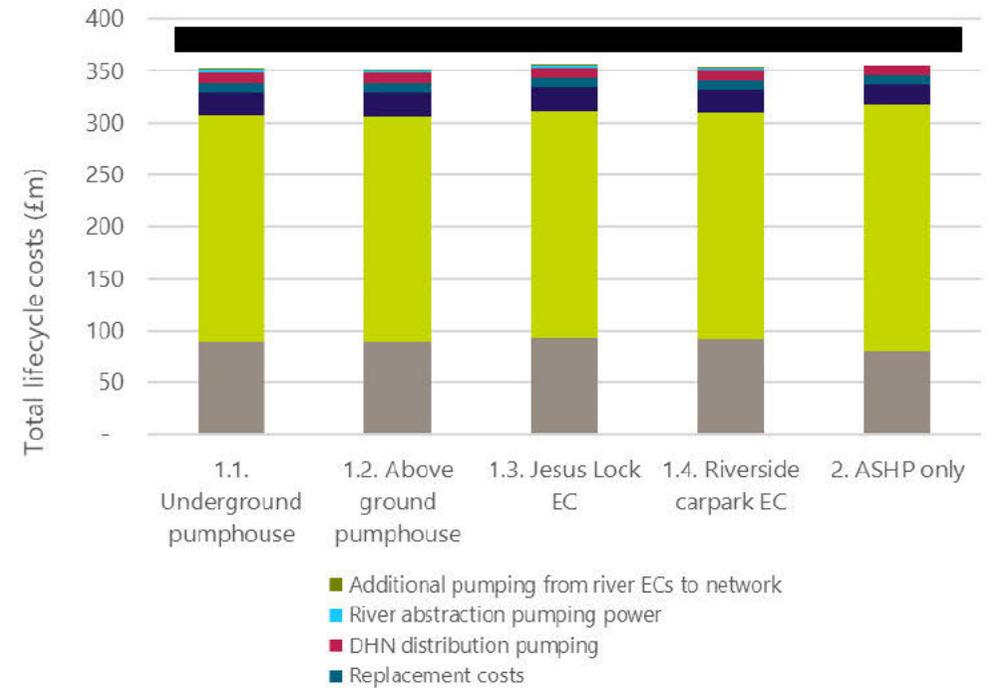


Figure 4—8 Shortlisted options undiscounted whole life-cycle costs

### 4.8.3 Shortlist – Carbon Appraisal

Lifetime carbon emissions of each of the shortlisted scenarios have been assessed based on the Green Book long-run marginal grid electricity carbon projections, with the results summarised in Figure 4—9. Note that only operational carbon is presented, with embodied carbon assessment beyond the scope of this modelling stage.

Each of the district heating options save ~97% carbon emissions vs the business-as-usual gas-driven heating systems. More efficient heat generation from the RSHPs Option 1 in comparison to the ASHP-only solution in Option 2 results in slightly lower electrical consumption and therefore lower lifetime emissions.

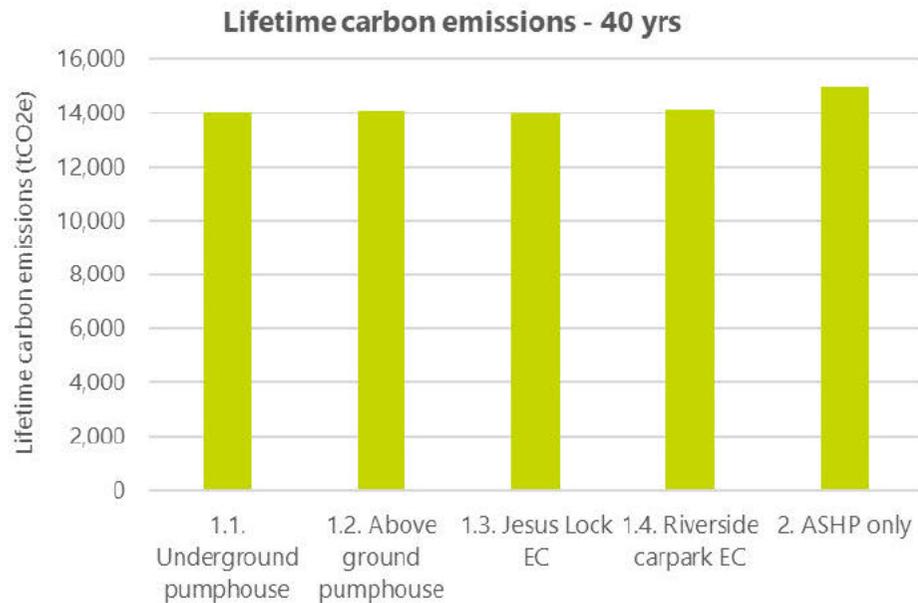


Figure 4—9 Shortlisted options lifetime carbon emissions

### 4.8.4 Shortlist – Risk Appraisal

Given that the economic and carbon performances of the shortlisted options are similar, qualitative appraisal of the key risks associated with each is key to selecting the Preferred Option. The key project risk categories that have been identified are described in Table 4—11. Each risk was rated for each shortlisted option on a scale of 1-5 for both likelihood and severity, with the product of these two numbers providing the total risk score with which to compare options. The detailed risk assessment evidence basis is provided in Appendix M, and a summary in Table 4—12.

Note that given that the Parkside Pools and BT Exchange energy centres are common across all options, many of the risks associated with these locations will apply mutually across each.

The risk appraisal shows that the Midsummer Common energy centre options (Options 1.1 and 1.2) are of significantly lower risk than the alternatives, in particular due to decreased risk associated with the design of the network.

Table 4—11 Shortlisted Options Risk Categories

| Risk           | Description  |
|----------------|--|
| Planning       | Risk associated with successfully achieving planning consent and the relevant permitting for the energy centres and abstraction pumphouse. |
| Land ownership | Risk relating to commercial agreements with the landowners for use of their land for energy centres/abstraction pumphouse.                 |
| Design         | Risk associated with the complexity/constraints around the buried network design, including uncertainties and potential extra costs.       |
| Flooding       | Risk due to flooding, including possible damage to equipment and water displacement impact.  |
| Construction   | Challenges relating to the construction phase, including programme, access and disruption.   |
| River Traffic  | Potential to impact normal marine traffic operation on the River Cam.  |
| Resilience     | Reliability/vulnerability to failure during network operation.   |

Table 4—12 Shortlisted options risk appraisal matrix

| Risk                                 | Option 1.1 – Midsummer Common underground pumphouse | Option 1.2 – Midsummer common above ground pumphouse | Option 1.3 – Jesus Lock                       | Option 1.4 – Riverside Car Park               | Option 2 – ASHP only                          |
|--------------------------------------|---|--|---|---|---|
| <b>Planning</b>                      | Likelihood: 3<br>Impact: 5<br><b>Risk: 15</b>       | Likelihood: 3<br>Impact: 5<br><b>Risk: 15</b>        | Likelihood: 4<br>Impact: 5<br><b>Risk: 20</b> | Likelihood: 3<br>Impact: 5<br><b>Risk: 15</b> | Likelihood: 4<br>Impact: 5<br><b>Risk: 20</b> |
| <b>Land ownership</b>                | Likelihood: 2<br>Impact: 4<br><b>Risk: 8</b>        | Likelihood: 2<br>Impact: 4<br><b>Risk: 8</b>         | Likelihood: 2<br>Impact: 4<br><b>Risk: 8</b>  | Likelihood: 2<br>Impact: 4<br><b>Risk: 8</b>  | Likelihood: 2<br>Impact: 5<br><b>Risk: 10</b> |
| <b>Design</b>                        | Likelihood: 3<br>Impact: 3<br><b>Risk: 9</b>        | Likelihood: 2<br>Impact: 3<br><b>Risk: 6</b>         | Likelihood: 4<br>Impact: 4<br><b>Risk: 16</b> | Likelihood: 3<br>Impact: 3<br><b>Risk: 9</b>  | Likelihood: 4<br>Impact: 4<br><b>Risk: 16</b> |
| <b>Flooding</b>                      | Likelihood: 3<br>Impact: 2<br><b>Risk: 6</b>        | Likelihood: 3<br>Impact: 2<br><b>Risk: 6</b>         | Likelihood: 3<br>Impact: 4<br><b>Risk: 12</b> | Likelihood: 3<br>Impact: 4<br><b>Risk: 12</b> | Likelihood: 0<br>Impact: 0<br><b>Risk: 0</b>  |
| <b>Construction</b>                  | Likelihood: 3<br>Impact: 4<br><b>Risk: 12</b>       | Likelihood: 3<br>Impact: 4<br><b>Risk: 12</b>        | Likelihood: 5<br>Impact: 4<br><b>Risk: 20</b> | Likelihood: 3<br>Impact: 4<br><b>Risk: 16</b> | Likelihood: 3<br>Impact: 4<br><b>Risk: 12</b> |
| <b>River Traffic</b>                 | Likelihood: 5<br>Impact: 1<br><b>Risk: 5</b>        | Likelihood: 5<br>Impact: 1<br><b>Risk: 5</b>         | Likelihood: 1<br>Impact: 5<br><b>Risk: 5</b>  | Likelihood: 5<br>Impact: 1<br><b>Risk: 5</b>  | Likelihood: 0<br>Impact: 0<br><b>Risk: 0</b>  |
| <b>Resilience</b>                    | Likelihood: 1<br>Impact: 3<br><b>Risk: 3</b>        | Likelihood: 1<br>Impact: 3<br><b>Risk: 3</b>         | Likelihood: 1<br>Impact: 3<br><b>Risk: 3</b>  | Likelihood: 1<br>Impact: 3<br><b>Risk: 3</b>  | Likelihood: 2<br>Impact: 4<br><b>Risk: 8</b>  |
| <b>Total Risk Assessment Scoring</b> | <b>58 / 175</b>                                     | <b>55 / 175</b>                                      | <b>84 / 175</b>                               | <b>68 / 175</b>                               | <b>76 / 175</b>                               |

## 4.8.5 Shortlisting Outcomes

Based on the analysis undertaken as part of the shortlist appraisal process, the recommendations for progression to Preferred Option are as summarised in Table 4—13.

Table 4—13 Shortlisted options outcomes matrix

| Option     | Primary CSF: LCOH (p/kWh) | Primary CSF: 40-year carbon emissions (tCO <sub>2e</sub> ) | Overall Risk Score | Secondary CSF: Potential Social Value Add  | Secondary CSF: Disruption Impact  | Secondary CSF: Sustainability and Innovation  | Recommendation - Note for all options there is a potential for margin of error at this stage of the cost modelling.  |
|------------|---------------------------|--|--------------------|--|---|---|--|
| Option 1.1 | 15.5                      | 14,060   | 58                 | Potential to incorporate a form of social value in energy centre design.<br>RSHP installation a strong example for education purposes. | Moderate due to energy centre locations and scale   | High – long term full electrification.<br>Incorporation of RSHP demonstrates additional innovation. | Alternative to Preferred Option <ul style="list-style-type: none"> <li>Very similar to recommended option, providing a technical alternative if above ground pumphouse is unfeasible.</li> </ul>   |
| Option 1.2 | 15.5                      | 14,070   | 55                 |  |   |   | Recommended for Preferred Option <ul style="list-style-type: none"> <li>Provides most cost-effective RSHP option</li> <li>Least overall risk option and technical risk around river abstraction is limited</li> <li>Could provide an innovative and visible project to demonstrate stakeholder's carbon reduction credentials</li> </ul> |
| Option 1.3 | 15.8                      | 14,010   | 84                 |  |   |   | Not Recommended for Preferred Option <ul style="list-style-type: none"> <li>Highest risk option, driven by the uncertainty around use of Jesus Lock</li> <li>Costly option</li> </ul>  |
| Option 1.4 | 15.7                      | 14,120   | 68                 |  |   |   | Not Recommended for Preferred Option <ul style="list-style-type: none"> <li>Most costly option</li> <li>Excessive network extension</li> <li>Planning risk in residential area very high</li> </ul>  |
| Option 2   | 15.4                      | 14,960   | 71                 | Potential to incorporate a form of social value in energy centre design.   | Moderate due to energy centre locations and scale.<br>Lower than Option 1 as only two energy centres compared to three. | High – long term full electrification.  | Not Recommended for Preferred Option <ul style="list-style-type: none"> <li>Presents high planning and design risks in terms of additional ASHP capacity at existing energy centre locations, an alternative location may be required</li> <li>Marginally least carbon efficient</li> </ul>  |

## 4.9 Preferred Option: Technical Development

**Disclaimer:** The Preferred Option developed in Sections 4.9 and 4.10 reflects the scenario detailed in Table 4—13., specifically a fully electrified heating system including electric boiler top-up. The techno-economic modelling process reflects this. However, following the sensitivity analysis in Section 4.10.12 and further analysis in the Financial Case, a decision was made by the Core Group to pivot to an interim gas boiler transitional scenario where for the first 15-years of network operation top-up is provided by gas and electrification is delayed until 2045. This decision was driven by the need for the project to present a competitive solution for both customers and investors whilst maintaining financial deliverability, which proved infeasible in the original Preferred option base-case. This also de-risked the availability of the updated grid capacity supply to the energy centre which is expected to trigger reinforcement upstream. Details of the new transitional Preferred Option are provided as an addendum at the end of the Preferred Option techno-economic modelling reporting in Section 4.10.13.

The selected Preferred Option meets the Strategic Objectives and CSFs as set out by the Strategic Partners. The Preferred Option has undergone further development following the shortlisting stage in order to refine the design and more accurately model the business case. This Section details the Preferred Option design development, as well as the techno-economic modelling process including key economic and carbon performance metrics.

### 4.9.1 Updated Demand Assessment

As referenced in Section 4.7.2.1, an updated demand assessment was carried out at Preferred Option development stage to more accurately define the MVP customer connections and model the anticipated heat loads. The following further engagement was carried out with Strategic Partners to inform this demand assessment update:

- A site visit was conducted to 16 city centre colleges to assess the technical feasibility of heat network connection, most likely connection points, eligible building clusters, installed heating plant capacity, phasing strategy and most likely low carbon counterfactuals. Engagement with estates/facilities management personnel was used to inform assumptions, and connection summaries were validated with strategic management staff.
- Further detailed discussions with University of Cambridge to determine connection points, connected building clusters and associated peak demands. Site visit(s) were also carried out to specific connections to assess technical viability and discuss local constraints with on-site facilities management teams.
- Assumptions relating to Cambridge City Council and Anglia Ruskin University have remained consistent with the initial demand assessment exercise.

Table 4—14 shows a summary of the modelled heat loads on the network. Total network loads are shown to protect the confidentiality of individual Strategic Partner data.

**Table 4—14 Preferred Option heat loads**

| Parameter                      | Unit     | Preferred Option |
|--------------------------------|----------|------------------|
| Number of connections          | -        | 48               |
| Total annual heat demand       | GWh/year | 73.0             |
| Undiversified peak heat demand | MW       | 43.6             |

## **4.9.2 Network Routing & Pipe Sizing**

### **4.9.2.1 Utilities and Other Constraints**

The initial network routing has been determined based on an analysis of load densities and constraints (including utilities, traffic management, archaeology), which has informed a proposed route through the city centre. An iterative process was followed with stakeholder engagement informing de-risking and optimisation of the proposed route.

Figure 4—10 summarises the outcomes of the desktop utilities search analysis carried out on the initial proposed route. Several existing utilities were identified alongside potential pinch points, as can be expected in the urbanised and historical Cambridge City Centre. The locations shown in the desktop C2 utility survey are however only an approximation and at varying levels of accuracy i.e. without depth information available and likely to omit some utilities (e.g. those abandoned by old utility providers, private drainage or buried obstructions).

Further investigations (i.e. a Ground Penetrating Radar (GPR) / Electromagnetic Location Survey, (EML)) are required to determine a more accurate position of utilities and obstructions.

Additional analysis has been carried out to determine network corridors likely to cause particularly disruption to traffic during the construction stage. Early engagement with Highways England has been initiated to begin de-risking future road-closure and permitting constraints. A high level summary of road segments that may represent particular risks in terms of closures and traffic management is presented in Appendix N.

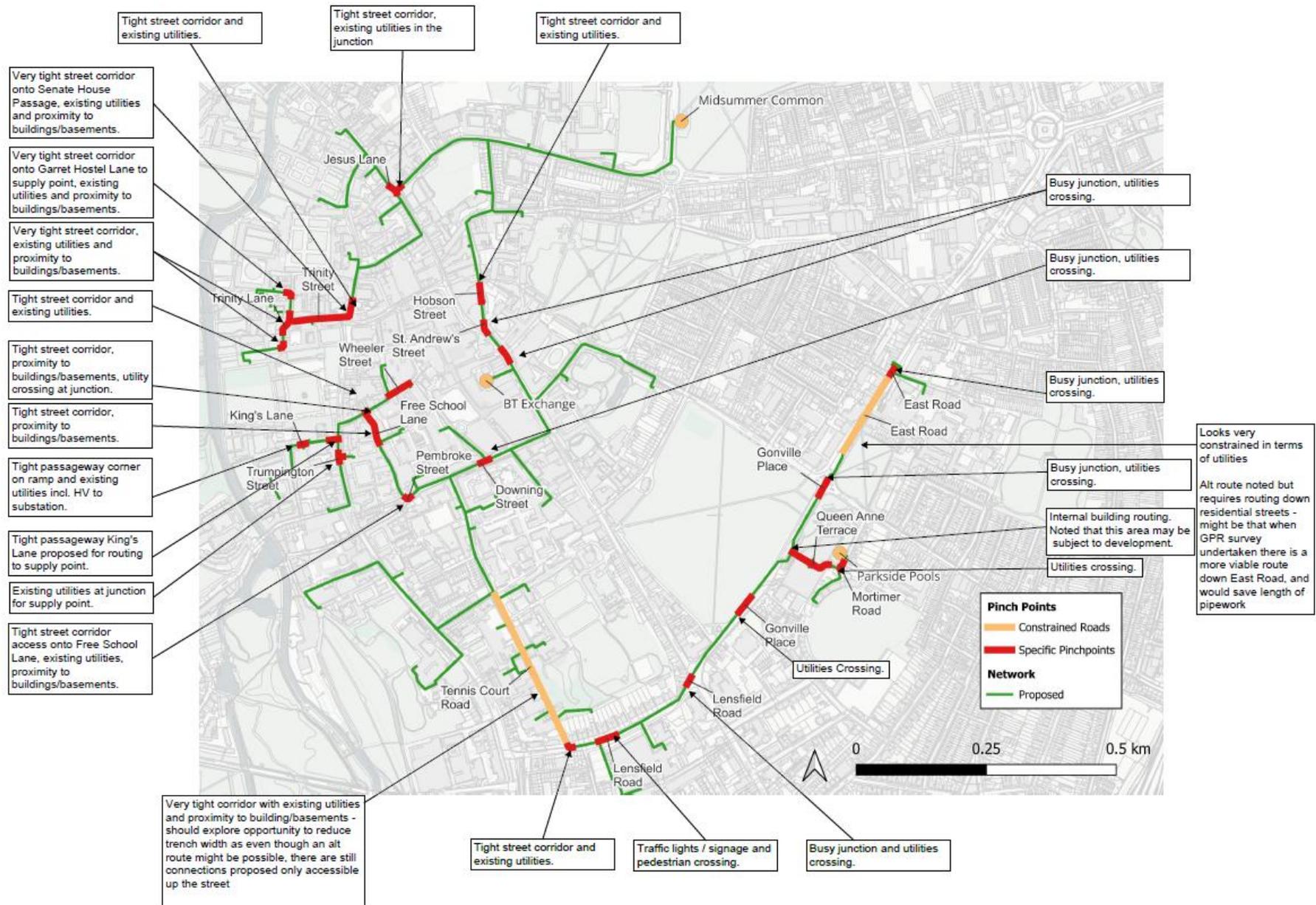


Figure 4—10 Infrastructure constraints analysis on initial proposed route

### 4.9.2.2 Developed Routing and Pipe Sizing

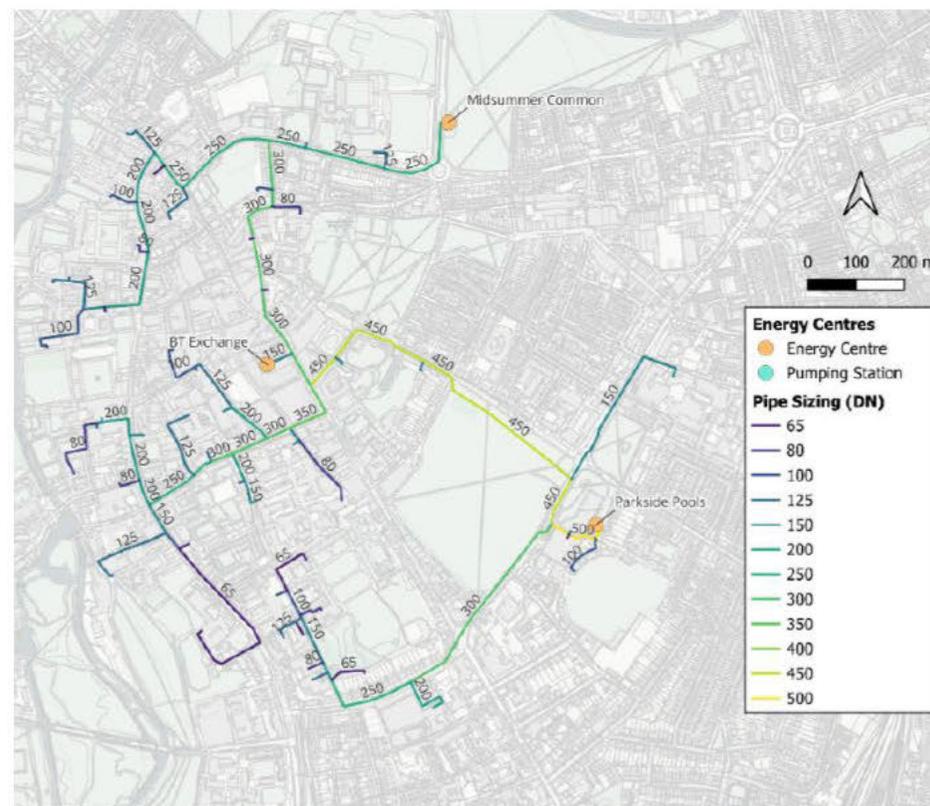
Based on this utilities constraints analysis, the network routing and pipe sizing was determined as detailed in Figure 4—11. The total proposed network length is 8,190m.

Due to the intention for the proposed MVP network to act as a first stage in a larger future network, additional upsizing of core pipework spines has been incorporated within the network design to safeguard future expansion of the network. This upsizing is included in Figure 4— and the impact described in further detail in the next section.

The majority of trenching for installation of the network runs through existing roads and highways, with an additional component of dig within hardstanding areas and a small proportion of soft dig (predominantly for the stretch of trunk mains that runs through Parker’s Piece). The total required network length at each pipe capacity is summarised in Table 4—15.

**Table 4—15 Preferred Option pipe sizing summary (includes expansion futureproofing beyond MVP)**

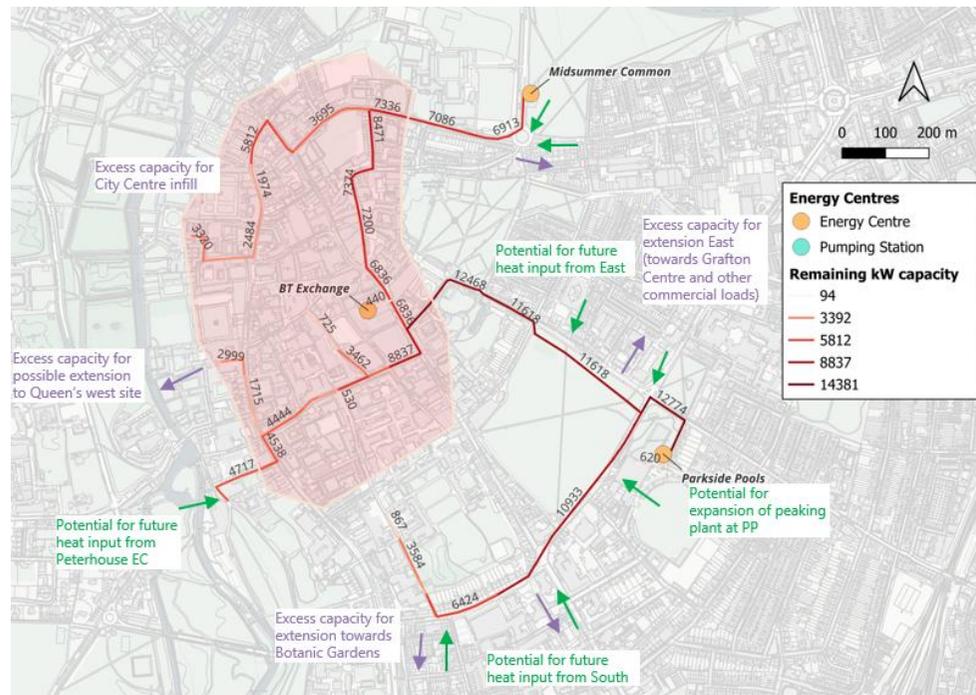
| Pipe DN      | Highways     | Hard Dig     | Soft Dig   | Total        |
|--------------|--------------|--------------|------------|--------------|
| 65           | 43           | 229          | 335        | 607          |
| 80           | 273          | 300          | -          | 573          |
| 100          | 110          | 403          | -          | 513          |
| 125          | 501          | 379          | -          | 880          |
| 150          | 557          | 159          | -          | 716          |
| 200          | 1,155        | 129          | -          | 1,284        |
| 250          | 1,290        | -            | -          | 1,290        |
| 300          | 1,239        | -            | -          | 1,239        |
| 350          | 154          | -            | -          | 145          |
| 400          | -            | -            | -          | -            |
| 450          | 397          | -            | 305        | 702          |
| 500          | 54           | 187          | -          | 241          |
| <b>Total</b> | <b>5,764</b> | <b>1,786</b> | <b>640</b> | <b>8,190</b> |



### 4.9.3 Network Expansion

Based on this strategic future-proofing exercise, the excess remaining capacity within the network trunk is shown in Figure 4—12, alongside the key directional opportunities for expansion / backfill beyond the MVP.

Initial zoning refinement in the city centre indicates a further >30GWh/year could be available within the MVP project area, with additional expansion opportunity zones to the south and west. In the future, this area is likely to become a Heat Network Zone which will mean that many of these connections are likely to be required to connect to the heat network.



### 4.9.4 Network Phasing

A network phasing strategy has been developed in coordination with the Strategic Partners to align proposed network build-out and building connections with customer boiler replacement programmes, site development plans and decarbonisation strategies. Based on these discussions the network delivery programme has been divided into two distinct phases:

- Phase 1 – Connection of heat loads from 2030-2032
- Phase 2 – Connection of heat loads in 2035

This proposed phasing programme is shown in Figure 4— The Phase 1 build-out has been spread across three years as a conservative measure to ensure that the construction timeline for the ~6.7km Phase 1 pipework is realistic, taking into consideration the highly constrained utilities corridors and the unique archaeological challenges Cambridge City Centre presents. Note that capital investments in the construction of the network will occur prior to 2030 (and therefore drawdown of GHNF grant funding if application is successful).

The phasing approach also enables sequencing of energy centre build-out, with commissioning of the energy centres staggered in order to delay capital requirement where possible whilst maintaining ~90% heat pump heat fraction (see Section 4.9.6 for plant sizing details). The energy centre build-out and year of commissioning is as summarised below:

- Parkside Pools – 2030-31; ASHPs installed across first two years of network operation, with top-up electric boilers installed across phases as required.
- Midsummer Common – 2031; RSHP installed to support heat generation in second year of network operation.
- BT Exchange – 2035; final ASHP energy centre only required upon connection of Phase 2 loads.

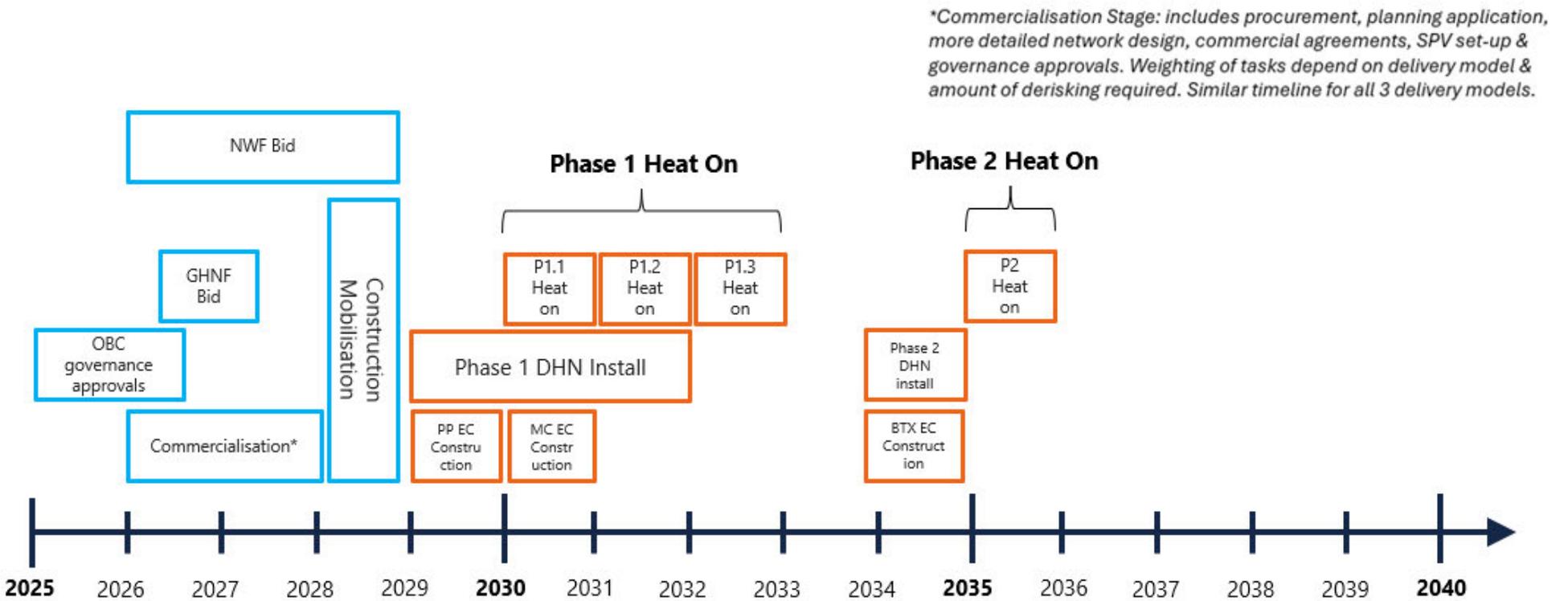


Figure 4—13 Proposed heat network phasing plan

## 4.9.5 Resilience Strategy

The CIBSE Heat Network Code of Practice (CP1) sets out requirements for redundancy, duty/standby arrangements, and operational protocols to ensure continuity of supply. Delivery partners will be expected to deliver to this guidance wherever practicable and HNTAS (Heat Networks Technical Assurance Scheme) provides additional guidance on resilience, measurement, and assurance for heat networks.

The resilience strategy addresses five key areas: energy centres, network, connections, operational and contractual:

### Energy centres:

- N+1 peaking plant capacity (i.e. redundant boiler capacity such that if any individual heating unit fails, there is sufficient back up capacity to ensure full heat output is maintained)
- Distribution of heat pump capacity across three separate energy centre locations, thereby allowing for continued low carbon provision of heat in case of interruption of supply at an individual energy centre
- Both Air and River-Source Heat Pumps are proposed. This mitigates the impact of extreme weather conditions causing disruption to the heat source through either freezing of the River Cam or excessively low air temperatures, notwithstanding the risk that these conditions could occur simultaneously
- Provision of thermal energy storage at the energy centre(s) and across the network provides a thermal battery, allowing continued provision of heat for a short period in case of failure to heat generation plant
- The thermal capacity of the water within the network acts stores thermal energy throughout operation, in principle acting as a thermal battery in operation. This would enable a period of residual heat supply in case of short outages of generation or sudden demand spikes
- Primary distribution pumps to be arranged in a duty/duty/standby arrangement. Each pump will be sized to provide 50% of the peak diversified demand of the energy centre

cluster, so that the full diversified demand can be met even if one pump is not operational. Pumps are also distributed across each energy centre

- Pressurisation and expansion units configured in a failsafe / auto-changeover arrangement. In the case of failure or scheduled maintenance of one unit, pressurisation and expansion duties can be passed on to the other unit
- Back-up power will be provided through a dual-circuit supply from UKPN, ensuring continuity of power supply in case of failure of one connection. The project is coordinating with the Local Area Energy Plan project to identify further opportunities with the city-wide power grid. Provision of diesel generators (temporary or permanent) for emergency power generation is an alternative option depending on cost and spatial implications that can be explored at later design stages
- Depending on space availability the project will aim to also include temporary plant connection points for bulk temporary heat generation at the energy centres.

### Network:

- Potential allowance for temporary plant connections at critical points of the distribution pipework. To be coordinated with Strategic Partners at later design stages
- Isolation chambers at critical points of the distribution pipework for sectional isolation and maintenance
- Sensors for leak detection, enabling any defects to be identified and rectified quickly.

### Connections:

- A twin plate heat exchanger configuration at each connection (unless too spatially constrained), typically sized at 50-60% of capacity each such that the maintenance strategy can be managed more effectively and ensuring that even if one were to fail a baseline heating supply can be maintained
- Strategic Partners can also choose to keep gas boilers as emergency back-up, if space is available and additional resilience is preferred (noting that, as per the next paragraph,

best practice is for heat networks to deliver >99% availability across the year). Whilst retention of gas boilers is not considered a necessity for a resilient supply, certain customers may seek to incorporate this within their planning.

#### **Operational:**

- A 24-hour 365-day operations team will be maintained, ready to respond in case of any emergency
- A robust emergency and disaster recovery plan will be developed to clearly define responsibilities, actions, key contacts and reporting in the case of unforeseen events impacting operation.

#### **Contractual:**

- Requirements to align with relevant industry standards and Good Practice, including the CIBSE Heat Network Code of Practice (CP1), which sets out essential technical guidance and standards for redundancy, duty/standby arrangements, and operational protocols to ensure continuity of supply. Delivery partners will be expected to deliver to this guidance wherever practicable, as well as the incoming HNTAS (Heat Networks Technical Assurance Scheme), which provides additional guidance on resilience, measurement, and assurance for heat networks
- Requirements for any delivery partner to deliver the network in accordance with strict Key Performance Indicators (KPIs). With the introduction of HNTAS in 2026 there will be the requirement to demonstrate compliance through an accredited certification scheme, with regular reporting of KPIs. Typical KPI's that could be set during the procurement could include Heat Availability KPIs with minimum response times for planned and unplanned heat supply interruptions; where the contractor may incur a points or cost penalty if heat supply is not restored within an agreed target period (typically 24hrs). Many contracts and technical standards for UK heat networks use 99% availability across a year as a benchmark for service reliability, aligning with best practice in district heating
- Heat network operation will shortly be regulated by Ofgem, becoming subject to the same service resilience requirements as gas and electricity supplies

- 

#### **4.9.6 Plant Sizing**

The Preferred Option network's heat generation plant has been sized based on energy PRO proprietary software modelling. The sizing philosophy targets a ~90% heat pump heat fraction across all phases, with the remaining peak demands delivered by electric boilers (*noting the updated Preferred Option in Section 4.10.13 includes transitional gas boilers also*).

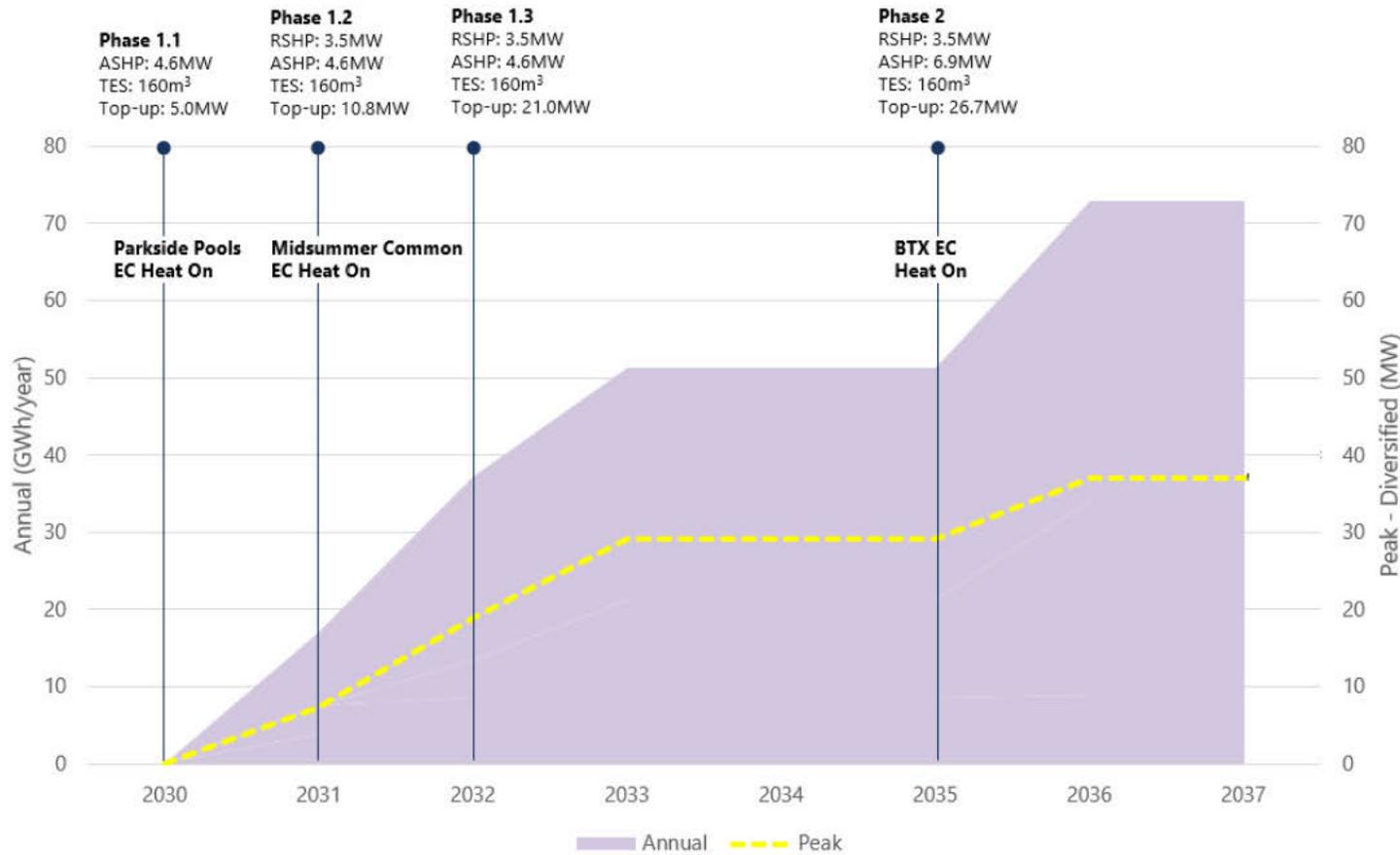
The demand modelling outcomes indicated a total heating requirement of 44MW across all MVP connections. Due to the range of building typologies and quantity of connections proposed, an 85% diversity factor has been applied when determining the total heat network demand, and therefore the electric boiler top-up requirement. This results in an estimated 37MW total heat generation capacity requirement. Future access to additional granular heat metering data may indicate diversification across the network is greater than modelled, reducing the peaking capacity requirement.

Thermal storage has been implemented as part of the energy centre heating systems as a cost-effective method of optimising heat pump heat fraction, reducing peak electrical capacity requirements, providing resilience and mitigating electricity price volatility risk. Due to spatial constraints at the proposed Parkside Pool Energy Centre location the capacity is limited to 2 x 80m<sup>3</sup> thermal storage units. However, potential additional satellite locations across the network are explored as part of the sensitivity analysis in Section 4.10.12.2.

The phased plant sizing requirement is shown in Figure 4—14 and Table 4—16. For further information on the energy modelling process and plant sizing constraints, see Figure 4—14.

**Table 4—16 Preferred Option phased plant sizing (includes N+1 boiler resilience)**

| Energy Centre    | Phase 1.1   | Phase 1.2                                   | Phase 1.3                | Phase 2         |
|------------------|---|---|--------------------------|-----------------|
| Parkside Pools   | 1 * 2.3 MW ASHP<br>2 * 80 m <sup>3</sup> thermal storage<br>2 * 9 MW electric boiler (inc. N+1) | 1 * 2.3 MW ASHP<br>1 * 9 MW electric boiler | 1 * 9 MW electric boiler |                 |
| Midsummer Common |   | 3.5 MW RSHP                                 |                          |                 |
| BT Exchange      |   |   |                          | 1 * 2.3 MW ASHP |



**Figure 4—14 Preferred option phased plant sizing**

#### 4.9.7 Electrical Requirements & Impact on Power Grid

The proposed heat network solution will have a significant electrical capacity requirement from the local grid, particularly at the Parkside Pools energy centre which will house the electric boiler peaking plant. The electrical demand build-up of the network aligns with the phasing strategy, as shown in Figure 4—15. At full build-out with heat pumps and electric boilers operational, a total of 32.0 MVA is required across the energy centres.

Engagement with UKPN has been carried out to determine the capacity in local substations and feasibility of electrical connection. UKPN has provided a budget estimate for the cost of connecting each energy centre, noting that these are **non-binding estimates** intended to aid decision-making, and final costs at formal offer may differ. A summary of budget estimate costs at each energy centre location is provided below:

- Parkside Pools:** a new point of connection can be made to Fulbourn Grid (22.5 or 42.0 MVA) as a secure supply. Dual-ducted 33kV cables will run via an approximately 8km circuit, including horizontal directional drilling required for railway crossing. The initial budget estimate indicates a total £8.65m connection cost. However, it is noted that upstream 132kV reinforcement may also be required, the costs of which are not included within the budget estimate and would need to be assessed at formal stage. UKPN have also indicated that the earliest completion date would be 2034 – this does not align with the network programme and will need to be negotiated during formal stage (*note the gas boiler transition scenario presented later mitigates against this*). However, it is noted that UKPN were not informed of the phasing strategy when making this budget estimate, which should reduce the requirements on the grid in the early stages of the network development and therefore may allow an alternative phased connection offer to be made. UKPN has already suggested that a smaller interim application—such as 10 MVA—could potentially be delivered by the 2030 target date. A formal application will provide greater certainty on scope, costs, and programme. In parallel, the ongoing Local Area Energy Planning (LAEP) work and a coordinated approach across Cambridge may create opportunities to bring forward delivery
- Midsummer Common:** connection is feasible through an extension of the existing HV Ringed Network along Victoria avenue and establishment of a new 1.7 MVA HV Metered Supply and transformer on-site. This includes excess capacity beyond the

1.2 MVA required for the heat pump to supply seasonal events that utilise Midsummer Common. Cost of connection is estimated by UKPN at £175k

- BT Exchange:** connection is feasible through connection to the HV network within the existing BT Exchange courtyard and establishment of a new 1.5 MVA transformer. Cost of connection is estimated by UKPN at £175k.

It may be possible to reduce the peak electrical requirement of the heat network through operation of the thermal stores in peak shaving mode, which aims to shift heating demand away from the peak, thereby flattening the daily consumption profile.

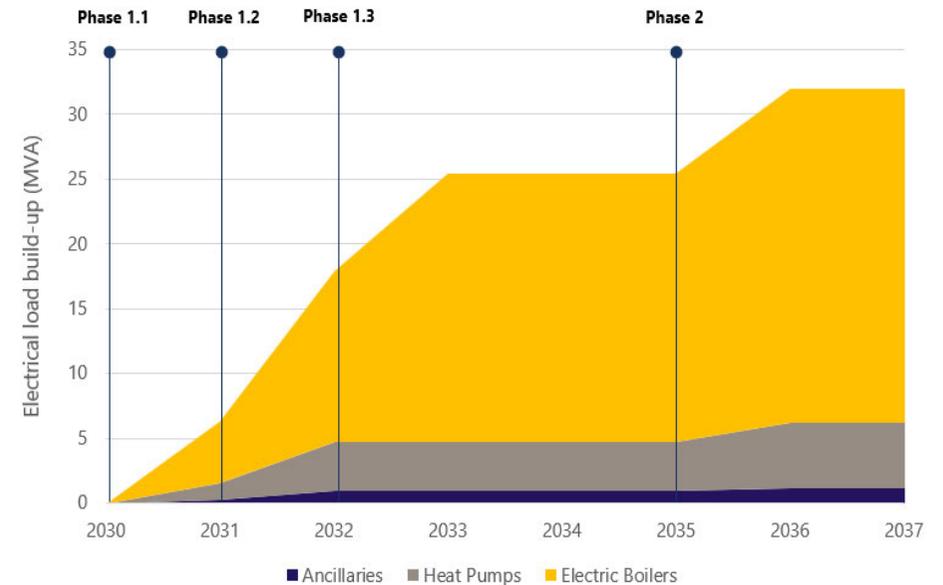


Figure 4—15 Preferred option electric load build-up

## 4.10 Preferred Option: Techno-Economic Appraisal

The Preferred Option has been subject to a techno-economic model assessment. This section outlines the Techno-Economic Model (TEM) analysis carried out to provide information on the capital and operational expenditure, costs to customers and carbon performance of the proposed CCCHN solution.

The TEM is a pre-tax model used to give an initial indication of costs, revenues and potential cash flows over time. This TEM is different to a financial model and is strictly pre-financing; it is not to be taken as financial advice. It is to be used as part of the OBC to identify project opportunities worth progressing to a deeper level of detail at the next project stage and provides inputs to the Financial Case modelling.

A bespoke techno-economic model was created to assess the economic performance and carbon emissions of the Preferred Option. The model produces the following key outputs:

- Phased capital expenditure (CAPEX) of the technologies deployed
- Annual operational expenditure (OPEX) resulting from fuel imports (natural gas and electricity) and technology operation and maintenance (O&M)
- Replacement expenditure (REPEX) primarily of the energy generation technologies following the end of the equipment lifetime
- Revenues from connection charges, heat sales and standing charges
- Annual carbon emissions arising from primary energy consumption.

The model also evaluates the return on investment over the lifetime of the project (assumed at 40 years) using the Discounted Cash Flow (DCF) methodology. The key TEM metrics produced are the Net Present Value (NPV), the internal rate of return (IRR) and the Social Internal Rate of Return (SIRR) of the project:

- NPV is the difference between incoming and outgoing cash flows. The value of the net cash flow throughout the scheme's lifetime is discounted at a specific rate per year (using Green Book rates), as the future value of money is expected to be lower than its present-day value. Hence, the net cash flow considered in terms of present value of money is NPV. A positive NPV means the scheme is making a profit, whilst

a negative NPV represents a loss on initial investment over the lifetime of the scheme

- IRR is a metric used to compare the commercial attractiveness of one scheme to another and is represented by a percentage. It is the discount rate required to deliver an NPV of zero over the scheme's lifetime
- SIRR evaluates the overall return value of a project to society, both economically and socially. The SIRR is calculated in much the same way as the financial IRR, except that it instead considers both the private and social costs and benefits over the lifetime of the project.

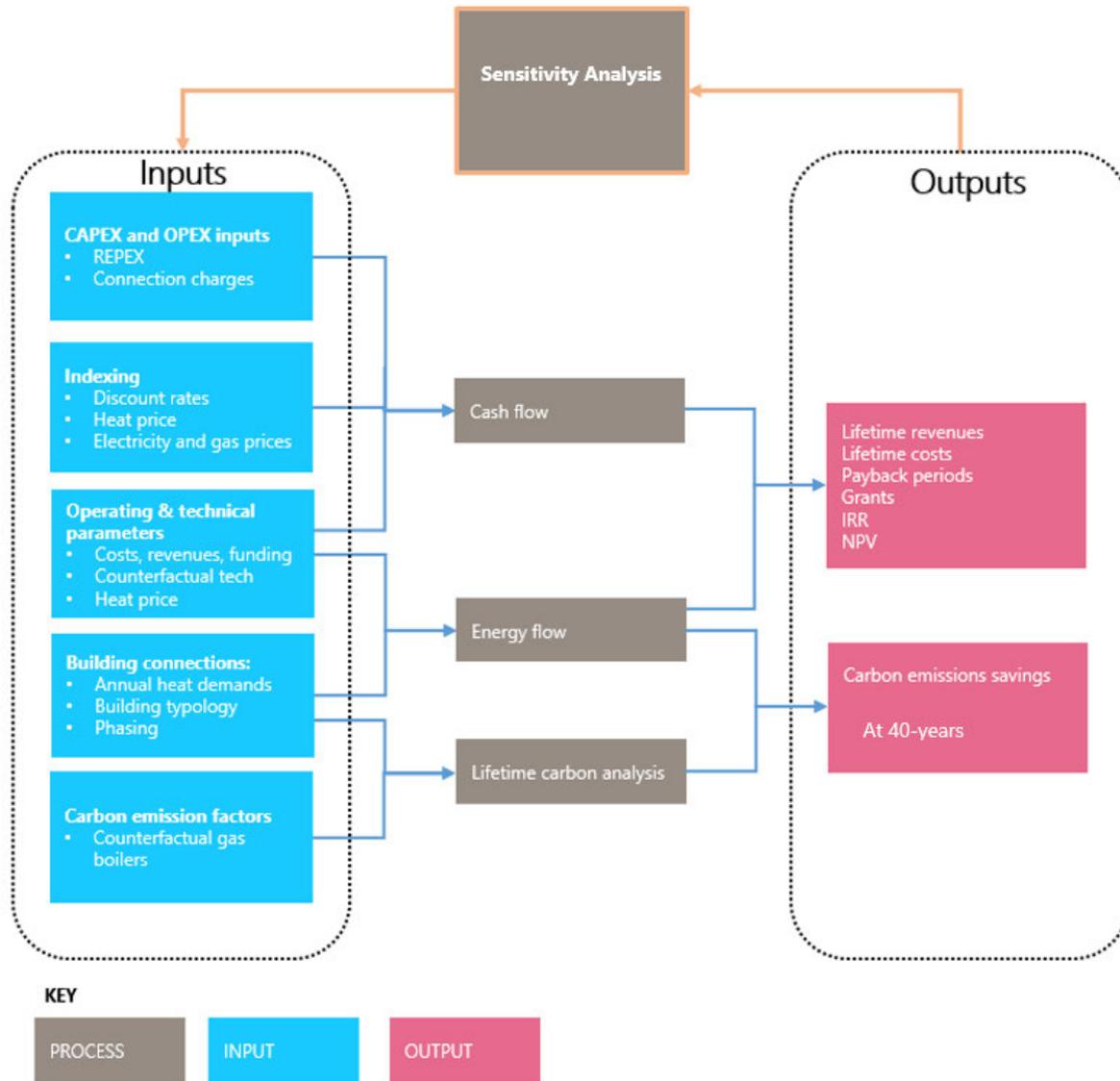
### 4.10.1 Modelling Approach

A techno-economic cash flow model was built in MS Excel combining the technical details of the scheme (capital and operational) with appropriate cost/price inputs to generate an annual cash flow. This enabled an assessment of viability (pre-tax) using Net Present Value (NPV) and Internal Rate of Return (IRR) as key indicators over a 40-year period.

Key assumptions are listed in Appendix O and include:

- All costs provided in 2025 real rates
- The network operator would act as a bulk heat supplier, owning and operating the energy centres and distribution networks up to and including the heating substations located at each customer connection. Any works beyond this point are within the scope of the customer
- Customers will pay an upfront connection charge upon connection to the network
- Heat is sold to each customer at a variable rate and standing charge
- Heat losses for a high temperature heating network are assumed at 10% as based on CIBSE CP1 guidance
- Pumping power and other ancillary plant power has been calculated for in addition to the electricity requirement for the main heating plant at the energy centres
- Customers are connected in a phased manner to the heat network as described in Section 4.9.4 of this report.

A process diagram for the techno-economic modelling approach is illustrated in Figure 4—16.



**Figure 4—16** Techno-economic modelling approach

#### 4.10.2 Low Carbon Counterfactual

The low carbon counterfactual for each proposed MVP connection represents the most viable alternative low carbon heating solution if the CCCHN was not progressed. The counterfactual is used as a basis for establishing the heat sales price, standing charges and connection charges, with the intention being that the Preferred Option offers a cost-competitive alternative that would be attractive to potential customers.

The low carbon counterfactual solutions were developed through consultation with the stakeholders and agreement on the modelling conditions. They have been modelled using a bottom-up approach and benchmarked cost rates depending on the technologies agreed with the Strategic Partners.

Note that the counterfactuals are each modelled independently of one another. In practice if all Strategic Partners were to progress local decarbonisation solutions, the deliverability of each individual solution will likely be impacted due to backlogs in the supply chain and decreasing capacity on the grid, which may leave late movers with limited decarbonisation options.

For the purposes of this techno-economic analysis, the counterfactual scenario is considered the aggregation (or blend) of all individual counterfactuals. As such, network performance is compared against the 'blended' counterfactual – for a specific customer focussed comparison of connecting to the heat network versus the local counterfactuals, see the Customer Tariff Notes issued separately to each Strategic Partner.

Table 4—17 Modelled Counterfactual Technologies

| Counterfactual Scenario                | Description  | Number of Connections |
|--|--|-----------------------|
| ASHP only                              | ASHPs provide the full heat load. Applicable to both centralised and decentralised systems.  | 14                    |
| ASHP / electric boiler – decentralised | A proportion of the site/building is heated by ASHPs, whilst the remaining is heated by electric boilers. No interconnection between the separate heating systems.   | 7                     |
| ASHP / electric boiler – centralised   | ASHPs provide the baseload to a centralised heating system, with top-up heat provided by electric boilers. Requires on-site heating pipework to distribute the heat. | 19                    |
| RSHP only                              | RSHPs provide the full heat load. Applicable to both centralised and decentralised systems.  | 2                     |
| RSHP / ASHP - centralised              | RSHPs provide the baseload to a centralised heating system, with top-up heat provided by ASHP. Requires on-site heating pipework to distribute the heat.             | 1                     |
| Electric boiler only                   | Electric boilers provide the full heat load. Applicable to both centralised and decentralised systems.   | 5                     |

#### 4.10.2.2 Counterfactual Cost Estimate Key Assumptions

Low carbon counterfactual solutions have been modelled based on a similar methodology to the proposed network for fair comparison, noting the following inclusions:

Modelled cost items include:

- Heat pumps & electric boilers
- Mechanical and control systems
- Upgrades to on-site electrical equipment where required
- UKPN grid reinforcement costs (socialised across customers on the understanding that local grid infrastructure will require reinforcing in the case of widespread electrification of heat supply)
- Cost uplifts have been included, parallelling the on-costs and contingencies applied when modelling the CCCHN as described in Section 4.10.4. However, it should be noted that bespoke uplifts associated with specific deliverability risk at each connection are not included beyond a blanket 10% as aligned with the connection capital costs of the CCCHN. The unique challenges in Cambridge City Centre are likely to result in increased counterfactual costs due to a range of circumstances, including but not limited to working with listed buildings, bespoke solutions in tight spaces, archaeological risk and higher than expected grid upgrade costs. Whilst the 10% uplift is intended to capture this impact, the uncertainty within these risks is likely to result in increased practical counterfactual costs on a case-by-case basis, which it is important for customers to be aware of.
- Resilience included in heating plant sizing; 20% capacity uplift for decentralised systems, and full boiler top-up in centralised systems. Certain customers may desire an even more conservative resilience approach in practice, which would increase counterfactual costs.

The following key items have been excluded from the counterfactual analysis:

- **Energy efficiency measures / building fabric retrofit:** The CCCHN has been designed for high temperature heat supply to enable connection of poorly insulated buildings without the need for invasive/costly retrofit. The counterfactual scenarios have been similarly modelled with high temperature heat pumps (with case-by-case exceptions as discussed with individual Strategic Partners). Whilst it is noted that some customers would look to implement building efficiency improvements as part of their counterfactual, there is significant uncertainty in modelling costs for these interventions without carrying out building surveys and further design. Modelling of high temperature heat pumps therefore represents a fairer cost-comparison. It is noted that the costs associated with lower temperature systems plus building efficiency measures can vary significantly, and typically where parallel building fabric improvements are required tend to be more expensive than a high-temperature alternative
- **Capital cost of secondary networks:** whilst existing plant rooms may be reutilised, in many cases a new or extended secondary network is also required. New secondary networks are excluded from both the counterfactual and heat network cost calculations. Where required, customers will need to fund this separately. In some cases, this is like for like with the counterfactual, as Institutions intend to install centralised heating as part of the counterfactual regardless of heat network connection. In other cases, the counterfactuals propose decentralised heat generation (for example heat pumps in some buildings, electric boilers in others), which does not require investment in a new secondary network but is typically more costly in terms of heating plant. Any secondary network install is an individual Strategic Partner capital cost, which also needs to be budgeted for.

Counterfactual cost estimates represent the current understanding of realistic counterfactuals based on the limited information available. Only by undertaking detailed on-site analysis can accurate counterfactual costs be developed, accounting for specific local circumstance and deliverability. If Strategic Partners are willing to share more data, collective confidence in forecast counterfactuals will be improved. Initial indications show that practical counterfactual costs are likely to be higher, making the heat network more competitive.

*It should be noted that design of the counterfactual systems has not been undertaken as part of the heat network development, and the proposed solutions considered a high-level*

estimation based on consultation with potential customers. Costs associated with the counterfactual systems as presented in this business case should be considered as indicative for guidance in estimating customer tariffs only and are based on benchmarks and industry best-practice or previous project experience. Use of these figures beyond assessment of the CCCHN Business Case is not recommended. It is recommended that customers undertake their own due diligence on low carbon counterfactual solutions to accurately understand the cost and performance implications on their sites.

#### 4.10.2.3 Counterfactual Capital Costs

A capital cost schedule has been developed for each connection, estimating the cost of installing the counterfactual heating system. A summary of the total counterfactual capital costing is shown in Table 4—18. A bottom-up approach has been followed and costs benchmarked for each connection. Further detail in counterfactual CAPEX modelling assumptions is provided in Appendix O.

**Table 4—18 Counterfactual capital costs summary**

| Counterfactual CAPEX item | Inclusions   | Total cost (£m) |
|---------------------------|--|-----------------|
| Air Source Heat Pumps     | Heat pumps, acoustic enclosure   | ████████        |
| River Source Heat Pumps   | Heat pumps and river abstraction plant   | ████████        |
| Electric Boilers          | Boiler units   | ████████        |
| Mechanicals and Controls  | Pipework between heat pumps and plant rooms, control systems, modifications to existing systems & decommissioning of boilers | ████████        |
| Electrical Plant          | On-site electrical infrastructure  | ████████        |

| Counterfactual CAPEX item | Inclusions   | Total cost (£m) |
|---------------------------|--|-----------------|
| Grid Connection Costs     | Reinforcements to the local grid (assumed socialised between all connections)                                | ████████        |
| Additional Costs          | Heritage allowance, testing & commissioning, design fees, preliminaries, overheads & profits & contingencies | ████████        |
| Total                     |  | ████████        |

#### 4.10.2.4 Counterfactual O&M and Replacement Costs

The ongoing operational cost of the counterfactual has been determined as a % of capital cost spent on operation and maintenance each year. Replacement costs are determined based on the estimated life-expectancy of the main plant items, with the capital cost of replacing plant items annualised over their lifetime. All replacement costs are included and budgeted for within the 40-year Business Plan.

A metering cost of £500/building/year has also been assumed as based on typical rates seen in the market.

#### 4.10.2.5 Counterfactual Fuel Costs

The low carbon counterfactual solution fuel costs have been calculated based on their total electricity consumption, multiplied by the electricity tariff. The electricity tariff matches the Green Book electricity retail price trajectory used in the techno-economic modelling of the CCCHN and includes both the standing and variable portions.

As electricity prices fluctuate over time, the heating tariffs are indexed to changes in electricity prices within the techno-economic modelling as per the Green Book price trajectory. This allows any reductions/increases in fuel costs over time to be passed on to customers through discounts/increased fees, helping to ensure fair heat pricing.

It should be noted that the Green Book retail rates provide a range (from 12.5p/kWh Low – 18.8p/kWh Medium – 42.7p/kWh High in 2022 terms). The medium price trajectory has been utilised when modelling the counterfactual and techno-economic modelling fuel costs, however the impact of fuel at the extremes of the range is explored in the sensitivity analysis.

#### 4.10.2.6 Counterfactual Costs Summary

As based on the low carbon counterfactual costs described in this Section, the capital, variable and fixed costs each low carbon counterfactual solution have been estimated. A summary of the counterfactual technology life costs is shown in the following table. It should be noted that the cost structure will change on a case-by-case basis depending on the site-specific requirements and stakeholders have been provided with their individual site details in separate connection detail notes. Further information on the assumptions can be seen in Appendix P.

[REDACTED]

| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
|------------|------------|------------|------------|------------|------------|
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |

#### 4.10.3 Revenues

Project revenues are made up of two streams; up-front connection charges for customers to connect to the heat network, and ongoing heat tariffs (both the variable heat sales rate and the fixed standing charge) which are paid over the project lifetime for continued supply of heat.

Customer connection charges and tariffs have been set with two key drivers in mind:

- Providing sufficient project revenues to maintain a positive cashflow and ultimately a 40-year IRR that is commercially attractive enough for project delivery
- Providing an offer to customers that is overall more cost-effective than pursuing the blended counterfactual solution across the modelling 40-year project life.

Revenues are closely linked with the counterfactual modelling results, with the counterfactual capital, fixed and fuel costs informing the development of heat tariffs.

##### 4.10.3.1 Connection Charge

The customer connection charge is based on the size of the heating substation required to connect. It has been determined based on the avoided cost in joining the network compared to the low carbon counterfactual - [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

### 4.10.3.2 Heat Tariff

The heat tariff is structured into two elements:

- **Variable heat sales rate (p/kWh)** – price paid per unit of heat consumed by the customer, reflecting the blended counterfactual fuel costs (as based on Green Book electricity price projections) and charged based on kWh/year annual heating demand
- **Fixed standing charge (£/kW)** – flat rate reflecting blended counterfactual operations & maintenance, metering & billing, replacement costs and utilities standing charges, charged based on kW peak heating demand.

*It is important to note that these heat tariffs cannot be compared like for like with gas / electricity utilities tariffs.*

A variable and fixed-rate heat tariff for use in the techno-economic model, has been derived from the operation, maintenance, constructions costs and overall heat demand, see Figure 4—17. The setting of charges has been guided by market trends, and customer expectations as informed by the blended counterfactual, see Table 4—20.

This tariff structure is only used for assessing the Business Case and is not intended to represent the tariff that the scheme operator will propose, but rather realistic rates to guide the modelling. Estimated connection costs are not a final offer: they are for 2025 real values (pre-inflation and pre-procurement).

**A 15% discount on variable rate has been included within the Preferred Option modelling versus the blended counterfactual in order to ensure the cost of heat network connection.**

It is noted that the forecast Connection Charges are at the top end of market ranges, in part due to the use of electric boilers to achieve full electrification from first Heat On in 2030 and likewise due to the unique decarbonisation challenges presented in Cambridge City Centre.

Partners may have local data to test projected costs against similar decarbonisation projects, whether delivered or planned. It is advised that Partners carry out this comparison to more accurately quantify the benefit of connection to the CCCHN as opposed to local decarbonisation solutions.

Note variable rates are indexed against the Green Book retail fuel price projections as based on the energy centre fuel mix (in this case 100% electric) in order to reflect expected fluctuations in fuel prices over the project lifetime and pass through expected reductions to customers.

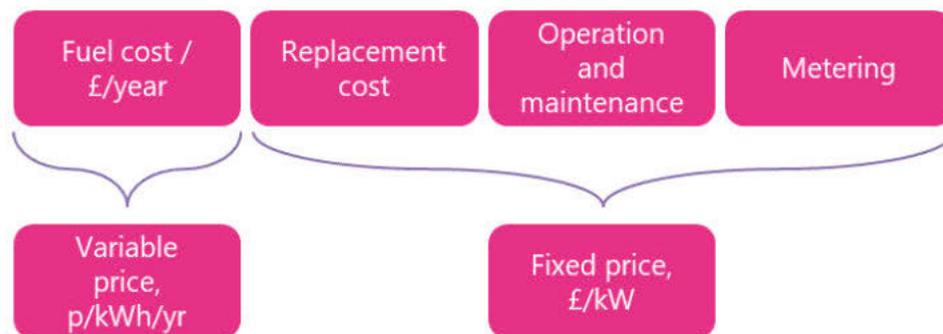


Figure 4—17 Variable and fixed rate tariff structures

| [REDACTED] |            |            |            |            |
|------------|------------|------------|------------|------------|
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |

#### 4.10.4 Capital Costs

Capital costs for the proposed CCCHN scheme have been provided by Currie & Brown cost consultants, in combination with supplier quotations obtained by Buro Happold. Where possible the cost consultant has contacted the market to understand the latest prices for cost items, otherwise they are informed by industry experience and previous projects.

Additional costs have been applied to cost items to reflect the expected uplifts for testing, design fees, preliminaries, contract overheads & profits etc. These were informed by engagement with the cost consultant and are summarised in Table 4—21.

Note also that an additional uplift has been applied to certain cost items relating to project specific risks, such as possible archaeological constraints, heritage risks, complex design requirements or otherwise. These more specific risk-related cost uplifts are intended to reflect the unique challenges presented by installing a network in Cambridge City Centre and are broken down in detailed in the following Section 4.10.4.1. Each of these additional fees has been compounded against the cost totals to calculate the uplift.

An additional uplift of 15% for contingency has been applied to the total capital cost to allow for unforeseen circumstances and optimism bias – this rate is in line with contingency factors applied across other Green Heat Network Fund applications.

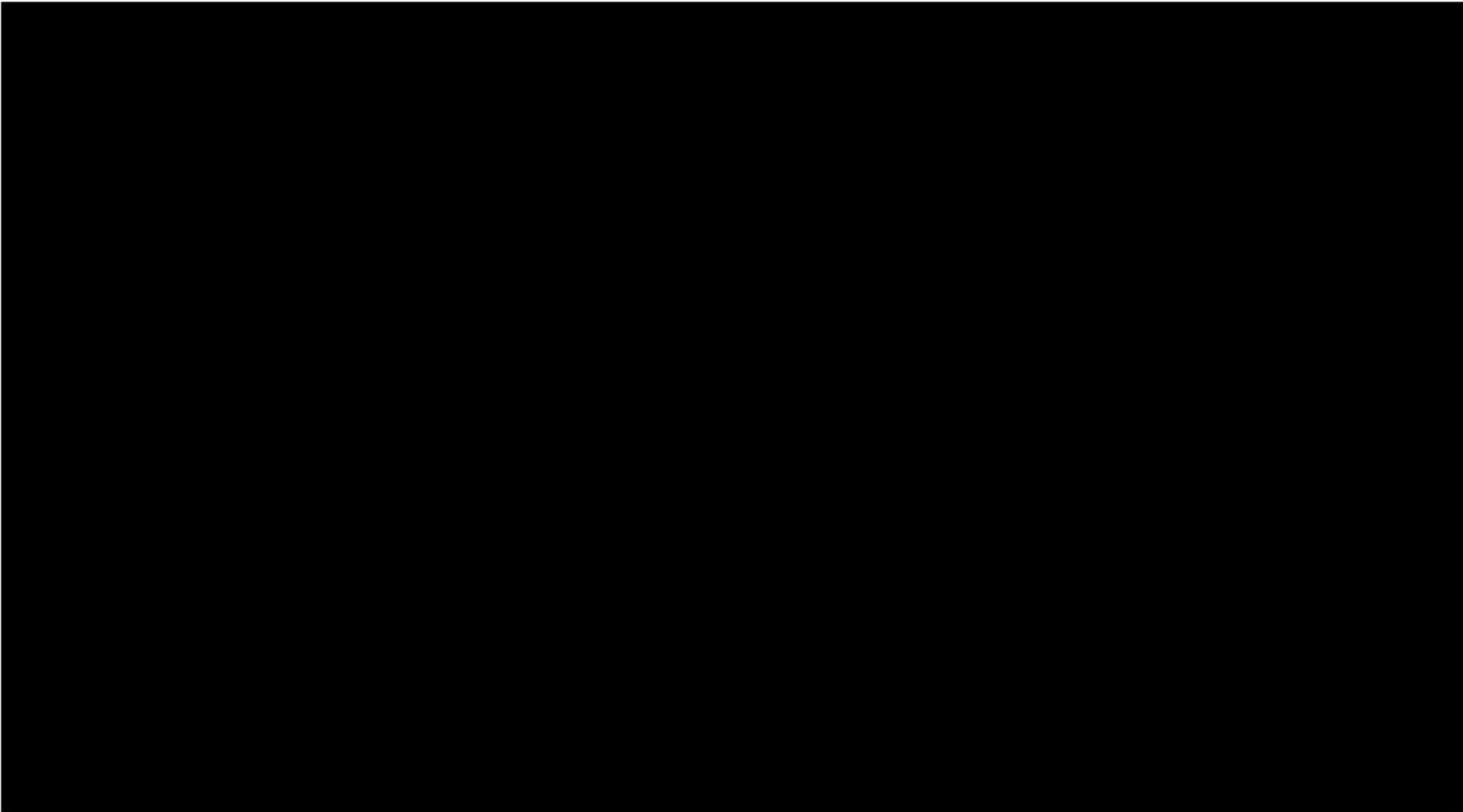
A total capital requirement of [REDACTED] has been identified for the Preferred Option. Table 4—22 summarises the costs, whilst Figure 4—18 shows the build up across phases.

**Table 4—21 Additional cost uplifts applied to capital costs**

| Capital cost uplift category | Percentage uplift  |
|------------------------------|--|
| Testing & Commissioning      | 2.5% - Applied to relevant plant and infrastructure only |
| Design fees                  | 5%   |
| Preliminaries                | 15%  |
| Overheads & Profits          | 9%   |
| Additional risk-related fees | 5-12.5% - see Section 4.10.4.1                           |
| Contingency                  | 15%  |

**Table 4—22 Preferred Option capital costs summary**

| CAPEX item                           | Inclusions  | Total cost (£m) |
|--------------------------------------|---|-----------------|
| RSHP                                 | High temperature ammonia heat pump  | [REDACTED]      |
| Other river abstraction plant        | Abstraction equipment including strainers, filters, pumps, PHX etc.   | [REDACTED]      |
| ASHP                                 | High temperature hydrocarbon heat pumps   | [REDACTED]      |
| Other mechanicals                    | Electric boilers, network ancillaries, pumps, water treatment, thermal stores etc.  | [REDACTED]      |
| Energy centre building               | Structural and civils works, building services, includes allowance for architectural sensitivity  | [REDACTED]      |
| Electricals                          | Controls, transformers, LV/MV switchgear, electrical ancillaries  | [REDACTED]      |
| UKPN                                 | Grid upgrade costs as quoted by UKPN via budget estimates. Note these costs are particularly conservative and should be considered at the top-end of likely cost. | [REDACTED]      |
| Connections                          | Enabling works at connections, modifications to existing systems, heating substations, controls etc.  | [REDACTED]      |
| DHN                                  | Buried network pipework and trench costs. Includes allowance for permitting and traffic management  | [REDACTED]      |
| Archaeology / Heritage / Design Risk | Uplifts for archaeological risk, heritage constraints, spatial constraints etc.   | [REDACTED]      |
| Additional Costs                     | Testing & commissioning, design fees, preliminaries, overheads & profits  | [REDACTED]      |
| Contingency                          | 15% contingency rate  | [REDACTED]      |
| <b>Total</b>                         |   | [REDACTED]      |



#### 4.10.4.1 Optimism Bias

The unique challenges related to installing a heat network in the historic and space-constrained Cambridge City Centre create an additional factor of risk for the project. Whilst challenging to quantify exactly, discussions with cost consultants have enabled estimated cost uplifts to be applied to certain capital cost categories in order to reflect the increased chance of cost overruns due to additional design requirements, programme delays, unexpected constraints or otherwise. Additional mark-ups in specific areas of risk have been applied as detailed in Table 4—23. A cautious approach has been taken in these assumptions to avoid optimism bias.

A baseline contingency of 15% has been included in the cost schedule as detailed in Section 4.10.4. In the experience of the project team this contingency alongside the additional risk-related cost uplifts provides a sufficient buffer and layering in further contingency through optimism bias would exceed realistic levels and likely render the project undeliverable.

**Table 4—23 Preferred option capital costing additional risk factors**

| Network component | Design risk mark-up | Reasoning   |
|-------------------|---------------------|---|
| Energy Centres    | 5%                  | Advised by Currie and Brown. Whilst we have RIBA Stage 2 designs for mechanical and electrical, there is also archaeological risk associated with the Midsummer Common and Parkside Pools energy centres, and BT Exchange is still pending structural review. Ongoing discussions with Planning for Parkside Pools energy centre may lead to specific heritage design treatments for Parkside which remain to be fully determined.            |
| Network           | 12.5%               | Advised by Currie and Brown given the high level of archaeological uncertainty in Cambridge. If a sensitive area is discovered the contractor will be required to pause construction and the relevant authorities notified. What might have been machine excavated in a day could take several days if not weeks to clear (by specialist archaeological team). The contractor will likely be entitled to an extension to the programme (at no |

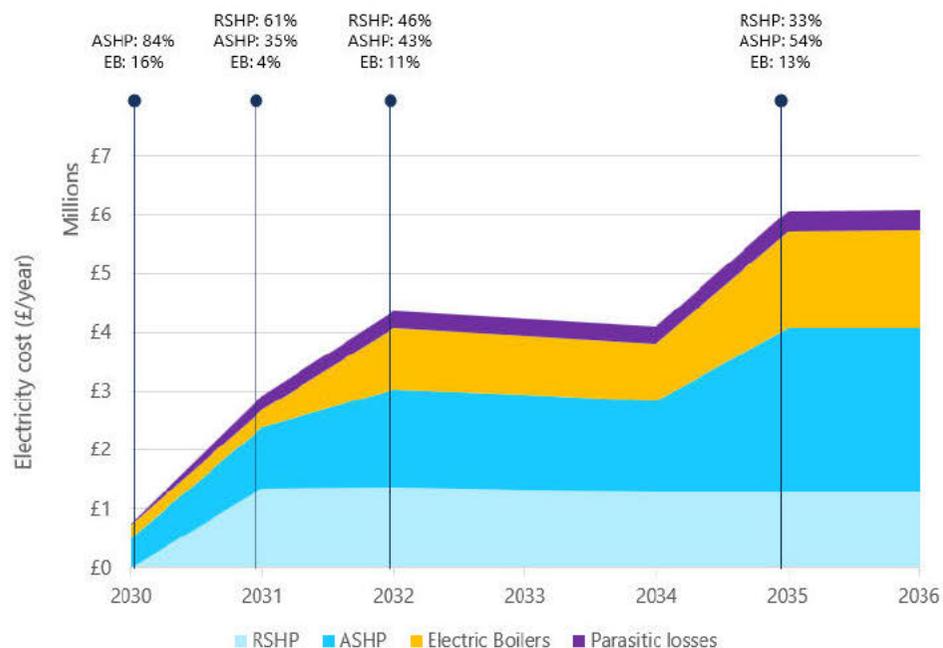
| Network component             | Design risk mark-up | Reasoning  |
|-------------------------------|---------------------|--|
|                               |                     | extra cost to themselves) and the client / developer may have to fund the specialist dig. Additionally, GPR surveys are required particularly in areas known as highly constrained with utilities from C2 records, with many of the roads very narrow. The project may in some cases need to find alternative, potentially longer, routes.   |
| Counterfactuals / Connections | 10%                 | Advised by Currie and Brown given the uncertainties around archaeology (the Cambridge Archaeology Unit, responsible for 75% of the archaeological digs undertaken in the city-centre to date, identified that College land for the pipe routes should be limited as much as possible). In addition, this uplift incorporates some allowance for the challenges around working with highly constrained, listed buildings. The designs are also less developed on these sites as the project team have not had access to private utility plans for route proving or carried out RIBA 2 connection designs at this stage. |
| Midsummer Common Pump Station | 10%                 | Estimated given the further design development and likely increased costs required for the civils works on the riverbank.  |

#### 4.10.5 Fuel Costs

The quantity of fuel import has been determined based on an hourly energy balance model over four time slices. Table 4—24 and Table 4—19 summarise the network operation over these time slices. Network operation has been modelled to stay constant in the base-case following the Phase 2 time slice.

Fuel costs include allowances for primary network losses and parasitic (pumping) requirements.

Fuel import rates have been applied based on the Green Book Central forecast for Commercial/Public Sector, including Climate Change Levy (CCL). See Appendix O for more details. Due to this forecast fuel import rates are indexed over time in alignment with expected future electricity cost reductions. Note that as based on the Green Book forecasts the fuel costs also include associated standing charges.



**Figure 4—19 Preferred option fuel import cost trajectory, including heat fraction contribution from each heat generation technology**

**Table 4—24 Preferred Option electrical consumption and fuel import cost**

| Electrical consumption item  | Unit     | Phase 1.1 (2030) | Phase 1.2 (2031) | Phase 1.3 (2032) | Phase 2 (2035) |
|------------------------------|----------|------------------|------------------|------------------|----------------|
| RSHP                         | MWh/year | 0                | 8,058            | 8,429            | 8,442          |
| ASHP                         | MWh/year | 3,003            | 6,189            | 10,296           | 18,187         |
| Electric Boilers             | MWh/year | 1,391            | 1,743            | 6,420            | 10,730         |
| Parasitic losses             | MWh/year | 172              | 1,532            | 1,846            | 2,312          |
| Total electrical consumption | MWh/year | 4,566            | 9,464            | 18,562           | 39,670         |
| Total electrical import cost | £/year   | £759,000         | £2,927,000       | £4,364,000       | £6,076,000     |

#### 4.10.6 Operation & Maintenance

Operational costs include costs incurred for the operation and maintenance of the network and its associated plant. For plant and infrastructure these have been based on a combination of recommendations from suppliers, previous project experience and industry best practice. Additional costs have been included for metering & billing of the heat network and ongoing business admin/staffing expenditure. A more detailed breakdown of O&M cost assumptions is provided in Appendix O.

#### 4.10.7 Replacement costs

Replacement costs are the costs incurred to replace equipment at the end of its operational life expectancy. Replacement costs have been assumed to reflect full replacement of the plant / infrastructure and are therefore assumed to be equal to the capital costs, excluding any additional fees and contingency. A summary of the assumed plant life expectancies and replacement costs over the project lifetime is provided in Appendix O. All replacement costs are included and budgeted for within the 40-year Business Plan.

#### 4.10.8 Commercialisation

Commercialisation costs for the initial design and development of the project have been included in the TEM, with the model start date reflecting the first year of commercialisation. A [REDACTED] capital fee has been assumed based on previous experience from similar scale heat network projects. This cost is incurred over the first two-years of project development. [REDACTED] of this commercial funding requirement has been assumed available through the GHNF grant funding (see below) – the source of the remaining [REDACTED] will depend on the delivery model chosen and has been included in the model as a project cost.

#### 4.10.9 GHNF

The Green Heat Network Fund (GHNF) is deemed a critical funding source for this project. As such, careful consideration of the GHNF gated metrics was made through the development of the Economic Case. Table 4—25 summarises the gated GHNF eligibility metrics that were considered and how the Business as Usual, low carbon counterfactual and Preferred Option perform against these. The assessment shows that the low carbon counterfactuals would be unlikely to be eligible for the Green Heat Network Fund, whilst the Preferred Option passes all eligibility criteria.

[REDACTED]  
[REDACTED]  
[REDACTED]

The project will target a formal application in the Spring 2026 window, which is expected to be highly competitive. Initial engagement with Triple Point (DESNZ appointed delivery partner for the current phases of the GHNF) has indicated that the uniquely diverse Strategic Partner group, very high decarbonisation potential and ambition and scale of the CCCHN project is expected to empower the bid and place the project in a strong position for application success.

Table 4—25 Core gated metrics for the GHN

| Metric                          | Description  | Applicable to CCCHN | Business as Usual                                     | Low carbon counterfactual                                     | Preferred Option  |
|---------------------------------|--|---------------------|---|---|---|
| Carbon gate                     | 100gCO <sub>2</sub> e/kWh thermal energy delivered to customers  | Yes                 | Fail – 215gCO <sub>2</sub> e/kWh                      | Pass – 57gCO <sub>2</sub> e/kWh in 2030, decreasing over time | Pass – 58gCO <sub>2</sub> e/kWh in 2030, decreasing over time                                 |
| Customer detriment              | Domestic and micro-businesses must not be offered a price of heat greater than a low carbon counterfactual for new buildings and a gas/oil counterfactual for existing buildings                 | Yes                 | Pass  | Pass  | Pass – heating price does not exceed the equivalent cost of low carbon counterfactual heating |
| Social IRR                      | Projects must demonstrate a Social IRR of 3.5% or greater over a 40-year period  | Yes                 | N/A   | Expected Pass   | Pass – unfunded Social IRR of 15.5%   |
| Minimum Demand                  | For urban networks, a minimum end customer demand of 2GWh/year. For rural (off-gas-grid) networks, a minimum number of 100 dwellings connected.  | Yes                 | Fail - many connections below 2GWh/year annual demand | Fail - many connections below 2GWh/year annual demand         | Pass – 7.7GWh/year heating demand in 2030, rising to 73.0GWh/year by 2035                     |
| Maximum CAPEX                   | Grant award requested up to but not including 50% of the combined total commercialisation + construction costs (with an upper limit of £1million for commercialisation)                          | Yes                 | N/A   | N/A   | Pass – [REDACTED]   |
| Capped Award                    | The total 15-year kWh of heat/cooling forecast to be delivered will not exceed 4.5 pence of grant per kWh delivered  | Yes                 | N/A   | N/A   | Pass – for the purposes of the TEM and FM [REDACTED]  |
| Non-heat/cooling cost inclusion | For projects including wider energy infrastructure in their application, the value of income generated/costs saved/wider subsidy obtained should be greater than or equal to the costs included. | N/A                 | N/A   | N/A   | N/A   |

#### 4.10.10 Social IRR

The Social Internal Rate of Return (SIRR) assesses at the overall return value of a project to society, both economically and socially. It considers the full range of costs and benefits, both private and social, associated with a project. The SIRR is calculated in much the same way as the financial IRR, except that it instead considers both the private and social costs and benefits over the lifetime of the project.

$$\text{Social IRR} = \text{Economic IRR} + \text{Carbon Abatement Value} + \text{Air Quality Damage Cost}$$

To calculate the SIRR the costs and benefits are measured against the counterfactual where the proposed project is not implemented. As with a financial IRR, the SIRR is expressed in monetary terms. Therefore, to calculate the SIRR, it is first necessary to put a monetary value on all the relevant costs and benefits. The social benefits included are:

- **Air quality damage costs** - The Green Book supplementary guidance<sup>1</sup> provides air quality damage costs from primary fuel use in pence per kilowatt hour. These are used to evaluate the impact of the change in air quality of a proposed heat network
- **Carbon abatement value** - The Green Book supplementary guidance provides guidance on the value to society in saving one tonne of carbon. Therefore, the net social impact on carbon emissions can then be given a monetary value using DESNZ carbon prices. This can be used to compare the carbon emissions associated with supplying heat through the counterfactual heating technology and the proposed heat network.

#### 4.10.11 TEM Results

*Disclaimer: Prospective information for revenue, capital expenditure and operating costs have been derived from information provided by different sources. Buro Happold does not accept responsibility for such information. Buro Happold emphasises that the realisation of the prospective financial information is dependent upon the continued validity of the assumptions on which it is based. Buro Happold accepts no responsibility for the realisation of the prospective financial information; actual results are likely to be different from those shown in the prospective financial information because events and circumstances frequently do not occur as expected, and the difference may be material.*

All results presented are pre-tax, pre-inflation, pre-funding and exclude business rates. Please refer to the Financial Case (Section 5) for a detailed breakdown of the project's financial performance.

#### 4.10.11.1 Cash Flow

Table 4—26 shows a summary of the project cash-flow and key economic metrics as modelled in the TEM. Presented costs / revenues are undiscounted (excluding NPV)

**Table 4—26 Preferred Option TEM cashflow summary**

| Parameter                       | Unit         | Preferred Option – Pre-GHNF | Preferred Option – Post-GHNF |
|---------------------------------|--------------|-----------------------------|------------------------------|
| Commercialisation costs         | £            | ██████████                  |                              |
| Capital costs                   | £            | ██████████                  |                              |
| Replacement costs               | £            | ██████████                  |                              |
| Operation and maintenance costs | £            | ██████████                  |                              |
| Fuel costs                      | £            | ██████████                  |                              |
| Grant funding                   | £            | -                           | ██████████                   |
| Heat sales                      | £            | ██████████                  |                              |
| Connection charges              | £            | ██████████                  |                              |
| Total costs                     | £            | ██████████                  |                              |
| Total revenues                  | £            | ██████████                  | ██████████                   |
| NPV at 40-years                 | £            | ██████████                  | ██████████                   |
| Discounted payback              | £            | ██████████                  | █                            |
| IRR                             | %            | <b>3.2%</b>                 | <b>10.2%</b>                 |
| LCOH                            | <i>p/kWh</i> | <b>18.0</b>                 | <b>16.4</b>                  |

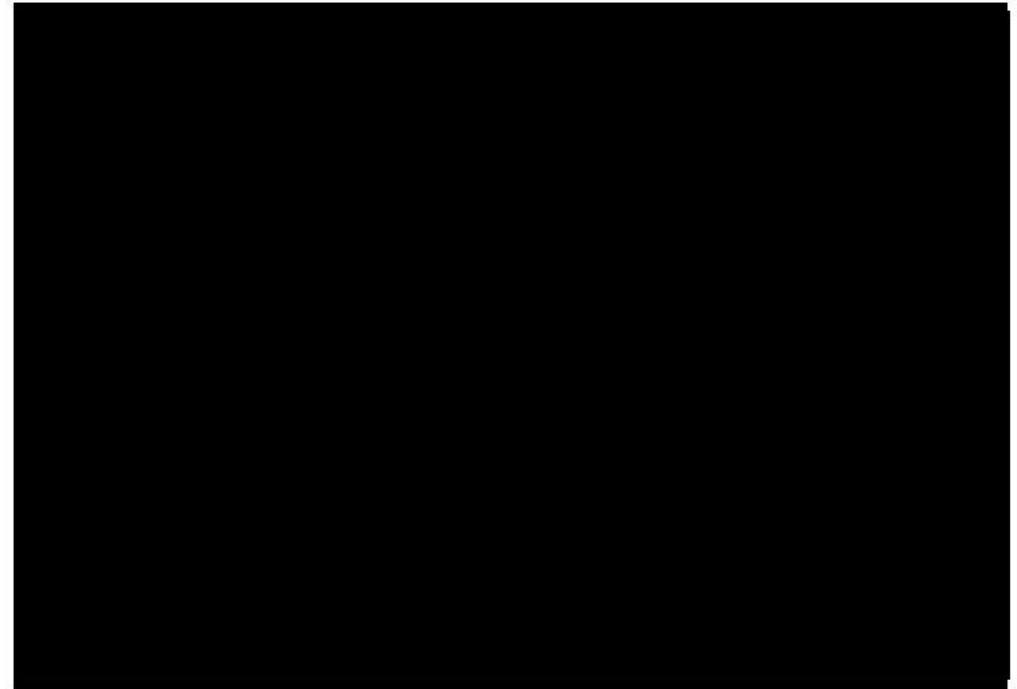


Figure 4—20 shows the cashflow of the project over its 40-year lifetime. The NPV of the network both with and without funding is also indicated. This indicates a positive cashflow over time and a return on investment over the project lifetime, with the funded option paying back within 12 years.



**4.10.11.2 Costs Comparison versus Counterfactual**

Table 4—27 compares the techno-economic costs of the heat network proposal versus the blended low carbon counterfactuals scenario. Costs are presented as real 2025 values and are linked to the programme dates.

Even prior to GHNf grant funding the cost of heat in the Preferred Option case is a discount on the modelled blended counterfactuals scenario.

**Table 4—27 Preferred Option vs Counterfactual cost comparison**

| Scenario                     | Capex  | Fuel Costs   | Fixed Costs (OPEX & REPEX)  | Levelised Cost of Heat (LCOH)   |
|------------------------------|--|--|---|---|
| Description                  | The upfront expenditure required to design, procure, construct and commission the heat network and its associated assets before any revenue is generated. Undiscounted rate. | The average forecast ed fuel costs associat ed with heat generati on | The ongoing cost required to operate, maintain, and manage a heat network once it is built and commissioned. Also includes replacement costs for network components at expected end of useful life. Undiscounted rate | LCOH is the cost per unit of useful heat delivered (p/kWh), including CapEx, OpEx & RepEx over the 40-year Business Plan, using Green Book discount rates. Excludes Green Heat Network Fund (GHNf) grant. |
| Preferred Option             | £117.5m  | £5.5m per year (averag e rate over 40-years)                         | £1.2m per year  | ██████████<br>██████████<br>██████████<br>██████████  |
| Counterfactuals <sup>1</sup> | £88.1m   | £6.2m per year   | £3.7m per year  | 19.4 p/kWh <sup>1</sup>   |

<sup>1</sup> Total low carbon counterfactual costs incorporating alternative technologies agreed with partners per connection. Estimates are conservative, based on standardised build costs.

### 4.10.11.3 Carbon

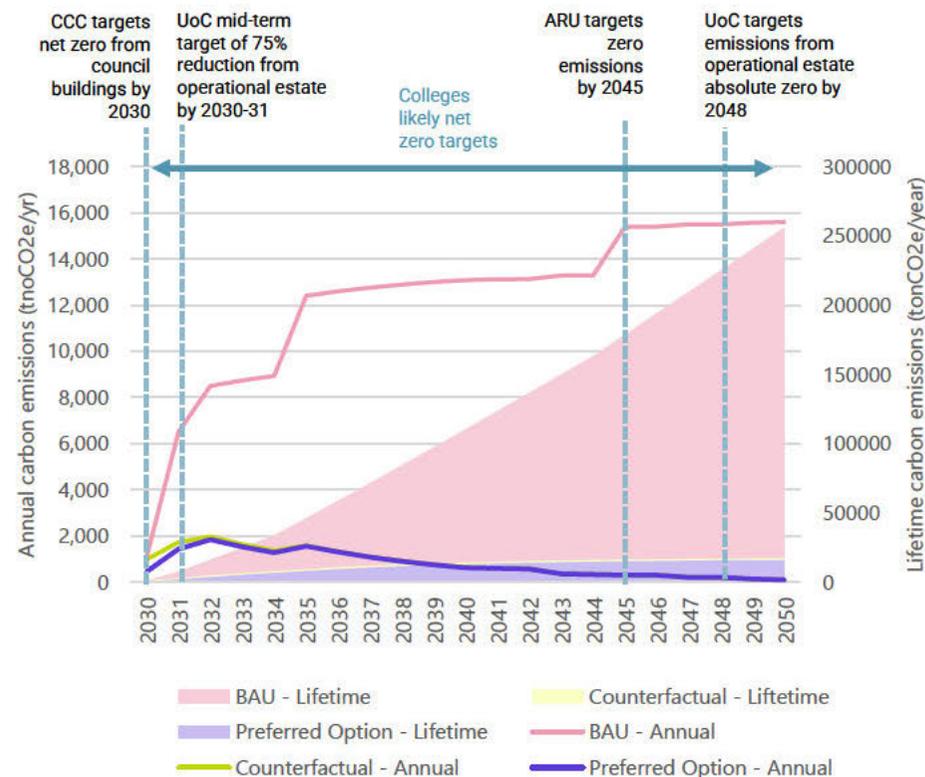
The Preferred Option has been assessed for its carbon emissions against the low-carbon counterfactual case and the simplified Business as Usual scenario. Green Book long-run marginal commercial/public sector grid carbon factors have been assumed, in alignment with the GHN assessment criteria.

The results indicate that over the project lifetime, the Preferred Option achieves a 96.8% carbon reduction versus the Business as Usual, a marginal improvement over the 96.6% reduction modelled in the low carbon counterfactual. This is based on 100% electrified solution and the scenario with transition gas is presented later in Section 2.11.13.

**Table 4—28 Preferred Option TEM carbon summary**

| Parameter                  | Unit                    | BAU     | Low Carbon Counterfactual | Preferred Option |
|----------------------------|-------------------------|---------|---------------------------|------------------|
| 40-year carbon emissions   | tonCO <sub>2</sub> e    | 546,000 | 18,700                    | 17,400           |
| Emissions reduction vs BAU | tonCO <sub>2</sub> e    | -       | 527,300                   | 528,600          |
| Emissions reduction vs BAU | %                       | -       | 96.6%                     | 96.8%            |
| Annualised carbon factor   | kgCO <sub>2</sub> e/kWh | 0.215   | 0.007                     | 0.007            |

Figure 4—21 shows the emissions of the network over the lifetime of the project versus the low-carbon counterfactual and Business as Usual. Emissions of the Preferred Option ramps up early on as more loads connect to the network, then decrease over time in alignment with the expected decarbonisation of the grid. This is closely aligned with the low-carbon counterfactual scenario given the overall similarities in technology mix (heat pumps and electric boilers) and full electrification.



**Figure 4—21 Preferred Option TEM carbon trajectory vs the BAU**

As highlighted at the beginning of Section 4.10, the carbon savings detailed here reflect the original 'Ambition' Preferred Option scenario with full electrification of heat supply through electric boiler top-up. For details of the carbon reduction impact from the transitional gas-boiler-based updated Preferred Option see Section 4.10.13.

#### 4.10.11.4 Social Impact

The 40-year social NPV and IRR of the Preferred Option are shown against the economic NPV and IRR in Table 4—29.

The social IRR comfortably exceeds the 3.5% threshold set in the GHNF eligibility criteria.

**Table 4—29 Preferred Option TEM social impact**

| Parameter  | Units | Preferred Option – Pre-GHNF | Preferred Option – Post-GHNF |
|------------|-------|-----------------------------|------------------------------|
| NPV        | £m    | ■                           | ■                            |
| IRR        | %     | ■                           | ■                            |
| Social NPV | £m    | ■                           | ■                            |
| Social IRR | %     | 15.2%                       | 25.2%                        |

#### 4.10.12 Sensitivities

Sensitivity analysis has been carried out on a series of key input parameters and heat network scenarios in order to understand the key opportunities for both betterment and risk to the CCCHN. Based on the outcomes of the analysis the base-case can be refined at future development stages.

##### 4.10.12.1 Key Input Sensitivities

Various sensitivities have been assessed to stress-test the proposed solution across key input parameters and understand the robustness of the business case. The following TEM input parameters have been modelled at ranges of +/- 10/20/30%:

- Capital costs
- Fuel costs
- Connection charges
- Variable heat tariff
- Fixed heat tariff
- Annual heat demand (inc. primary network losses)
- Primary network losses
- Heat pump efficiencies
- Variable heat tariff & Fuel costs (assuming increases or reductions in fuel costs are passed through to customers).

The sensitivity of the model to key inputs has been tested by changing each input in turn and assessing the impact on the NPV. The tornado chart shown in Figure 4—23 shows the impact on NPV of changing the key inputs listed above, for the Preferred Option scenario inc. GHNF contribution.

The purpose of undertaking this analysis is to establish which variables are key to project performance, and therefore which need particular management focus in order to mitigate future risk.

Table 4—30 provides comments on the impacts of each of the sensitivity changes and contextualises them with the expected heat network operation.

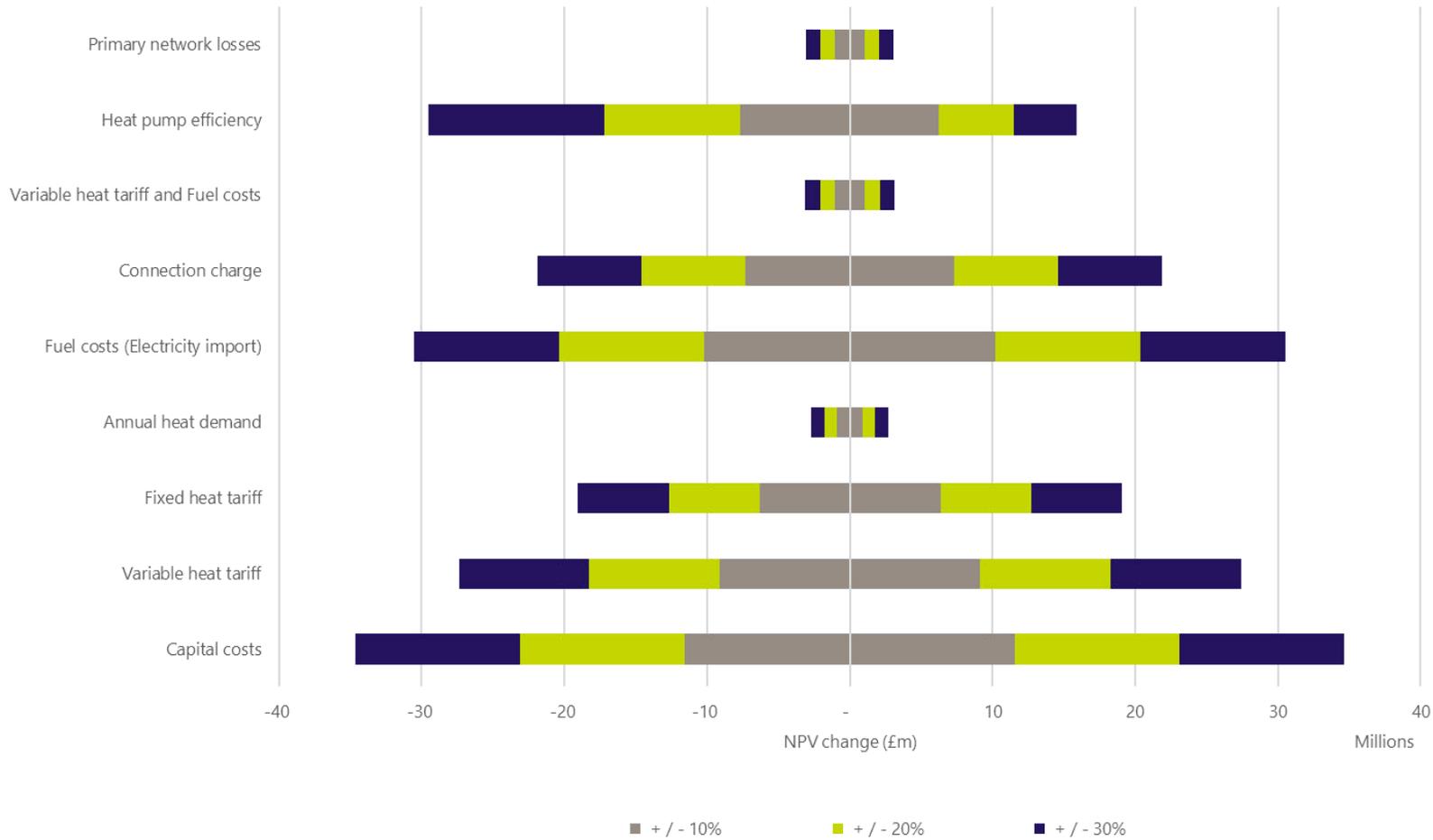


Figure 4—22 Techno-Economic modelling key input sensitivity testing – NPV impact

Table 4—30 Techno-Economic modelling key input sensitivity testing analysis – ordered in descending NPV impact

| Input sensitivity                   | Variable change | NPV impact | IRR impact | Sensitivity IRR | Comment  |
|-------------------------------------|-----------------|------------|------------|-----------------|--|
| Capital costs                       | +10%            | -11.5      | -4.7%      | 5.5%            | Influential factor impacting the project economic performance. This is largely due to the high costs associated with three separate energy centre buildings. The model has aimed to include sufficient contingency to mitigate the risk of excess capital costs, whilst reductions may be identified through betterment opportunities.   |
|                                     | -10%            | +11.6      | +9.7%      | 19.9%           |  |
| Fuel costs                          | +10%            | -10.2      | -2.9%      | 7.3%            | Very significant impact. In practice positive/negative impacts to electricity costs are likely to be passed through to customers, see 'Variable heat tariff and Fuel costs' sensitivity. However, although from a project perspective this mitigates cost impact, the reality is that the investors are likely to also be the customers and therefore will not be insulated from the impact of volatile fuel costs.  |
|                                     | -10%            | +10.2      | +2.5%      | 12.7%           |  |
| Heat pump efficiency                | +10%            | +6.3       | +1.6%      | 11.8%           | Reductions to heat pump SCoP has a very significant impact, whereas increases are less influential. Decreasing heat pump efficiency proportionally increases total electricity costs more than increasing efficiency reduces them due to the presence of the electric boilers.   |
|                                     | -10%            | -7.6       | -2.1%      | 8.1%            |  |
| Variable heat tariff                | +10%            | +9.2       | +2.3%      | 12.5%           | Significant impact. There is some discount in the variable tariff at present, however increasing tariffs beyond the low carbon counterfactual may impact GHNF eligibility criteria, whilst decreasing would likely result in insufficient IRRs.  |
|                                     | -10%            | -9.1       | -2.6%      | 7.6%            |  |
| Connection charge                   | +10%            | +7.3       | +5.1%      | 15.3%           | Significant impact. Noting the base-case offers customers a 5% discount on the low carbon counterfactual, there may be scope to slightly increase the connection charges if customers are willing to commit to connection at a higher rate.  |
|                                     | -10%            | -7.3       | -3.3%      | 6.9%            |  |
| Fixed heat tariff                   | +10%            | +6.4       | +1.6%      | 11.8%           | Fairly significant impact. Increasing tariffs beyond the low carbon counterfactual may result in break of GHNF eligibility criteria, whilst decreasing would likely result in insufficient IRRs.   |
|                                     | -10%            | -6.3       | -1.7%      | 8.5%            |  |
| Primary network losses              | +10%            | -1.0       | -0.2%      | 10.0%           | Very limited impact. Primary losses make up a very small contribution to network costs.  |
|                                     | -10%            | +1.1       | +0.3%      | 10.5%           |  |
| Variable heat tariff and Fuel costs | +10%            | -1.0       | -0.2%      | 10.0%           | Limited impact due to the relative balance between heat sales and fuel costs. With fuel costs and heat tariffs coupled benefits/drawbacks are passed through to the customers. This suggests the network is not particularly susceptible to volatile energy markets provided that this is built into the final tariff structure. However, as referenced above the project investors are also likely to be customers themselves therefore any passed through cost will ultimately still have an impact on their energy costs. |
|                                     | -10%            | +1.1       | +0.3%      | 10.5%           |  |
| Annual heat demand                  | +10%            | +0.9       | +1.2%      | 11.4%           | Limited impact. This is due to the relative balance between heat sales revenue and fuel costs. However, it should be noted that this sensitivity models reduced annual demand of connections, however, does not reflect removal of connections – customers choosing not to join the network would also impact connection charges and fixed rates, which would make this impact grow much more significant.   |
|                                     | -10%            | -0.9       | -0.9%      | 9.3%            |  |

#### 4.10.12.2 Sensitivity Scenarios

Further standalone sensitivity scenarios have been modelled on the Preferred Option to understand the impact that specific modifications to the network design and modelling might have on the economic viability. These sensitivity scenarios can be either advantageous, offering opportunity for betterment of the Preferred Option, or disadvantages, representing a risk to project deliverability. Note all report NPVs and IRRs include GHNf grant at a 2.35p/kWh capped award rate.

##### Betterment

Sensitivity analysis outcomes for the defined betterment scenarios are summarised in the following table.

Table 4—31 Betterment sensitivity scenarios

| Sensitivity scenario                 | Description   | NPV impact | IRR impact | Sensitivity IRR | Comment   |
|--------------------------------------|---|------------|------------|-----------------|---|
| Energy centres phasing swap          | Swapping the phasing of the Midsummer Common and BT Exchange energy centres, delaying the high efficiency RSHP heat generation in exchange for postponing capital expenditure.  | -£0.2m     | +1.0%      | 11.2%           | Due to the applied discount rate, in terms of IRR, delaying the capital cost of the more expensive Midsummer Common energy centre and pumping station outweighs the efficiency impact of moving from RSHP to ASHP for several of the early years of operation. However, it should be noted that there is considered to be greater commercial risk of utilising the BT Exchange energy centre in Phase 1 compared to the Midsummer Common energy centre. |
| Ammonia ASHP                         | Replacement of lower efficiency natural refrigerant ASHPs with a higher efficiency ammonia counterpart (274% vs 241% efficiency), noting risk of toxic gas leakage.   | +£5.6m     | +1.4%      | 11.6%           | This scenario offers a direct heat generation efficiency improvement vs the base-case. However, the modelling does not include any capital cost uplifts for more costly ASHPs or design to mitigate refrigerant leakage risk – in practice this would reduce the positive NPV impact. It would be recommended to investigate practicality of this technology further in the commercialisation stage.  |
| UKPN grid connection cost reductions | Reduced primary reinforcement costs from £5.7m to £2m, noting a potentially conservative estimate was assumed in the base-case TEM.   | +£4.3m     | +3.3%      | 13.5%           | Direct capital cost reduction in Phase 1.1 has significant IRR impact.  |
|                                      | Procurement of an Independent Distribution Network Operator (IDNO) to work with an Independent Connection Provider (ICP) to reduce connection costs and adopt power network infrastructure for an asset value.. Assumed 30% reduction in contestable works. | +£6.4m     | +5.5%      | 15.7%           | Direct capital cost reduction in Phase 1.1 has a significant IRR impact.  |

| Sensitivity scenario   | Description   | NPV impact | IRR impact | Sensitivity IRR | Comment  |
|--|---|------------|------------|-----------------|--|
|  | Postponement of primary grid reinforcement costs to Phase 2, assuming sufficient capacity is available to deliver Phase 1.  | +£1.0m     | +2.1%      | 12.3%           | Postponement of primary grid reinforcement costs reduces the NPV cost of this capital outlay.  |
|  | All of the above betterment opportunities.  | +£10.2m    | +13.6%     | 23.8%           | An ambitious cost reduction scenario for the UPKN connection costs has the potential to greatly improve lifetime IRR.  |
| Thermal storage optimisation   | Optimised thermal storage charging schedule, exploiting reduced spot prices overnight to offset more costly heat generation during peak demand hours – retained base-case 160m <sup>3</sup> thermal storage capacity. | +£1.6m     | +0.5%      | 10.7%           | Introduction of smart thermal storage control utilising Time of Use (ToU) electricity tariff fluctuations has the potential to reduce annual electricity costs by ~1.7% at full network build-out by prioritising thermal storage charging at times when grid import is cheapest and discharging when it is most costly. This does not require additional infrastructure beyond the base-case and is therefore a clear betterment opportunity, although the economic benefit is uncertain and relatively minor.  |
| Additional thermal storage capacity – 2 potential locations identified | As above, optimised thermal storage with a total of 300m <sup>3</sup> capacity, with the additional located at a satellite location.  | +£2.7m     | +0.4%      | 10.6%           | Expansion of thermal storage capacity through an additional satellite thermal storage location comes with an associated capital cost (~£0.9m uplift) for the additional infrastructure, however the optimised charging regime nevertheless provides an economic benefit over the base-case (~£6.8m electricity cost saving from a 3.7% reduction at full build-out). It should be noted that there is limited benefit from the additional thermal storage capacity beyond the 160m <sup>3</sup> scenario above in terms of IRR uplift. However, the lifetime NPV performance is marginally superior, and additional thermal storage capacity does come with further potential benefits to network resilience and peak shaving potential. As above, the economic benefit is uncertain as it relies on appropriate flexible tariff availability. |
|  | As above, optimised thermal storage with a total of 500m <sup>3</sup> capacity, with the additional located at a satellite location.  | +£3.3m     | +0.2%      | 10.4%           | Addition of a further satellite thermal storage location requires a total capital uplift of ~£1.9m beyond the base-case, however results in lifetime electricity import reductions of ~£9.3m (5.4% at full build-out) beyond the base-case. Again, there is limited benefit from the additional thermal storage capacity beyond the 160m <sup>3</sup> scenario above in terms of IRR uplift. - there may be opportunity to improve this through reducing number of satellite locations for combined storage site (thereby reducing capital uplift). The lifetime NPV performance is nonetheless improved, and additional thermal storage capacity comes with further potential benefits to network resilience and peak shaving   |

| Sensitivity scenario     | Description  | NPV impact | IRR impact | Sensitivity IRR | Comment  |
|--------------------------|--|------------|------------|-----------------|--|
|                          |  |            |            |                 | potential. As above, the economic benefit is uncertain as it relies on appropriate flexible tariff availability.   |
| Gas boiler peaking-plant | Replacement of the proposed electric boiler plant with new gas boilers for entire project lifetime, noting this does not achieve full degasification ambitions of Strategic Partners.  | +£30.3m    | +27.0%     | 37.2%           | Utilisation of new gas boilers as the peaking plant results in a significant capital cost reduction, in large part due to the avoided UKPN grid connection costs. Similarly, ongoing fuel costs are reduced by replacing the electric boiler contribution by much cheaper gas boiler generation. It should be noted that this scenario does however impact carbon reduction potential, reducing the emissions reduction from ~97% to ~84% vs the BAU.  |
|                          | Replacement of the proposed electric boiler plant with new gas boilers for first 15-years of operation only, after which they are replaced by electric boilers at expected end of project life (noting that boilers used for peaking only may be able to have their operation extended beyond brochure life expectancy, however will be transitioned out regardless due to the importance of eventual electrification) | +£11.7m    | +22.3%     | 32.5%           | Utilisation of gas boilers as a transitional peaking technology has a significant positive impact on lifetime economic performance. Decreased fuel import costs in the first 15-years of operation from the relatively cheap gas consumption result in improved cashflow, whilst delaying major UKPN grid upgrade cost leads to discounting of the capital requirement and reduces risk associated with securing such a large grid connection in the early years of the project. It should be noted that incorporating gas may increase the risk associated with GHN application. Incorporating gas boilers as a transitional technology does however slightly impact carbon reduction potential, reducing the lifetime emissions savings from ~97% to ~93% vs the BAU. This still represents a massive saving over the business as usual.<br><br>The results of the Financial Case indicate that from a financial perspective the deliverability of the base-case electric boiler top-up scenario is marginal. In light of this and due to the comparatively favourable economic performance of this gas boiler transitional scenario, a <b>decision has been taken to re-baseline the Preferred Option to prioritise the development of this transitional option in subsequent sections of the business case.</b> The drivers behind this decision and analysis of the techno-economic impact are detailed further in Section 4.10.13. |
| Heat network infill      | Connection 10% additional city centre heat loads without expansion of the heat generation infrastructure. Assumed cost uplift to buried network and connection costs relative to the   | -£1.5m     | +1.1%      | 11.3%           | Heat network infill offers a betterment to project IRR at the cost of lifetime NPV. This is due to the increased early project revenue from additional connection charges, which outweighs capital cost from network expansion and the impact of higher boiler heat fractions over   |



| Sensitivity scenario  | Description  | NPV impact | IRR impact   | Sensitivity IRR | Comment  |
|---|--|------------|--------------|-----------------|--|
|   | assumed to occur between commercialisation and construction.   |            |              |                 |  |
| Climate change impact   | Annual heat load reduction over project lifetime as based on potential climate model temperature reduction forecasting.  | -£0.2m     | -0.4%        | 9.8%            | Climate change impact has been modelled as a 0.9% annual year-on-year decrease in heat demand to 2050, at which point this reduction falls to 0.3%. The negative economic performance impact is a result of the decreased heat sales revenues over the project lifetime, which outweigh the decreased electricity import costs for running the network. Overall, the impact is relatively minor. |
| Alternative MVP connections scenarios                                 | Project progresses to Phase 1.1 only   | -£48.9m    | Negative IRR | Negative IRR    | Project performs very poorly due to high costs and low revenue. Reduced linear heat density (6.5 MWh/m) and high capital costs associated with the Parkside Pools energy centre, as well as low GHNF potential. Ongoing cashflow is only just positive.  |
|   | Project progresses to Phase 1.2 only   | -£26.0m    | -8.5%        | 1.7%            | Project performs very poorly due to high costs and low revenue. Reduced linear heat density (7.4 MWh/m) and high capital costs associated with the Parkside Pools and Midsummer Common energy centres, as well as low GHNF potential.  |
|   | Project progresses to Phase 1.3 only   | -£17.0m    | -6.0%        | 4.2%            | Project performs poorly due to high costs and low revenue. Reduced linear heat density (7.4 MWh/m). Much of the benefit of Phase 2 comes from infill of the network with high density heat loads, which drives linear heat density up to 8.9MWh/m and enables GHNF grant award to be maximised.  |
|   | ████████████████████   | ██████     | ██████       | ██████          | Project performs very poorly due to the decreased load density and revenue opportunities. Costs dominated by Parkside Pools energy centre.   |
|   | ████████████████████   | ██████     | ██████       | ██████          | Project performs poorly due to the decreased load density and revenue opportunities. Costs dominated by Parkside Pools energy centre.  |
| More conservative CAPEX scenarios (noting base-case already accounts) | Revisiting of capital costs to incorporate potential further risk associated network build-out in the Cambridge City Centre. This manifests through selection of 'high-risk' network segments to which is applied a dig-cost uplift, increase in | ██████     | ██████       | ██████          | Project performs poorly due to the additional ██████ capital costs. This could potentially be partially mitigated through additional revenues (e.g. tariffs, connection charges) or potentially additional funding request through GHNF.   |

| Sensitivity scenario          | Description   | NPV impact | IRR impact | Sensitivity IRR | Comment  |
|-------------------------------|---|------------|------------|-----------------|--|
| for significant project risk) | design risk associated with customer connections and an uplift in controls costs.   |            |            |                 |  |
|                               | As above but applied to the 15-year interim gas boiler peaking plant scenario described in Table 4—31. <i>Economic impacts adjacent are relative to the base-case electric boiler scenario.</i> | +£3.9m     | +8.5%      | 18.7%           | Project performs strongly due to decreased electrical import costs during first 15-years of operation and delayed UKPN costs despite the £14.5m increase in capital costs compared to the base-case.   |
| Electricity retail price      | Utilising the Low Green Book electricity retail price projection instead of Medium (12.5p/kWh vs 18.8p/kWh in 2022 rates). Impact applied to both fuel costs and heat sales rate.               | -£1.6m     | -0.3%      | 9.8%            | Reduction in electricity costs reduces the fuel import costs to the network, however the savings are also passed through to the customers through reduced heat sales rates (a reduction from 10.9p/kWh to 7.1p/kWh in 2025 rates). The reduction in revenues has a slightly greater impact on the network's economic performance than the reduction in fuel costs. Although the impact on economic performance is slightly negative, the reduction in tariffs to customers could result in a more attractive scheme and greater commercial interest. |

### 4.10.13 Preferred Option: Update - Transitional Gas Boilers

This section outlines the key drivers for switching the Preferred Option from an electric-boiler only top-up scenario to an interim gas boiler top-up (first 15-years of network operation), as well as a comparison showing the techno-economic impact.

#### 4.10.13.1 Ambitious vs Transitional Preferred Option

Following engagement with the Strategic Partners, consideration of delivery models, sensitivity testing and financial analysis of the Preferred Option, a decision has been taken to update the Preferred Option. The update is defined by a switch from the 'Ambitious Preferred Option' detailed in Sections **Error! Reference source not found.** and 0 to a 'Transitional Preferred Option', with the key adjustments being:

- Installation of gas boilers instead of electric boilers as the initial network peaking/back-up plant.
- Interim operation of these gas boilers for 15-years until expected end of life, following which they are replaced with electric boilers as per the original Ambitious Preferred Option scenario.

As referenced in the sensitivity analysis in Table 4—31, the Transitional Preferred Option benefits from reduced fuel costs over the first 15-years of the project (due to the lower relative cost of gas vs electricity), whilst delaying the capital intensive and time sensitive grid connection costs required for electric boiler peaking plant until later in the project life. This derisks the scheme from both a technical perspective (lower risk of delayed connection due to UKPN/National Grid lead-times) and an economic perspective (discounting of capital cost over time and potential cost savings from delayed grid connection).

The impact on carbon savings is marginal, with the Transitional Preferred Option still delivering 92.7% carbon savings (506,000 tonCO<sub>2</sub>e) compared to the Business as Usual heating strategy of the proposed connections over the 40-year project life, which is comparable to the 96.8% carbon savings (529,000 tonCO<sub>2</sub>e) from the original Ambitious Preferred Option.

The requirement to update the Preferred Option has been driven by the financial deliverability of the project, with the analysis in the Financial Case demonstrating the challenge in balancing both customer and investor viability in the Ambitions Preferred Option base-case.

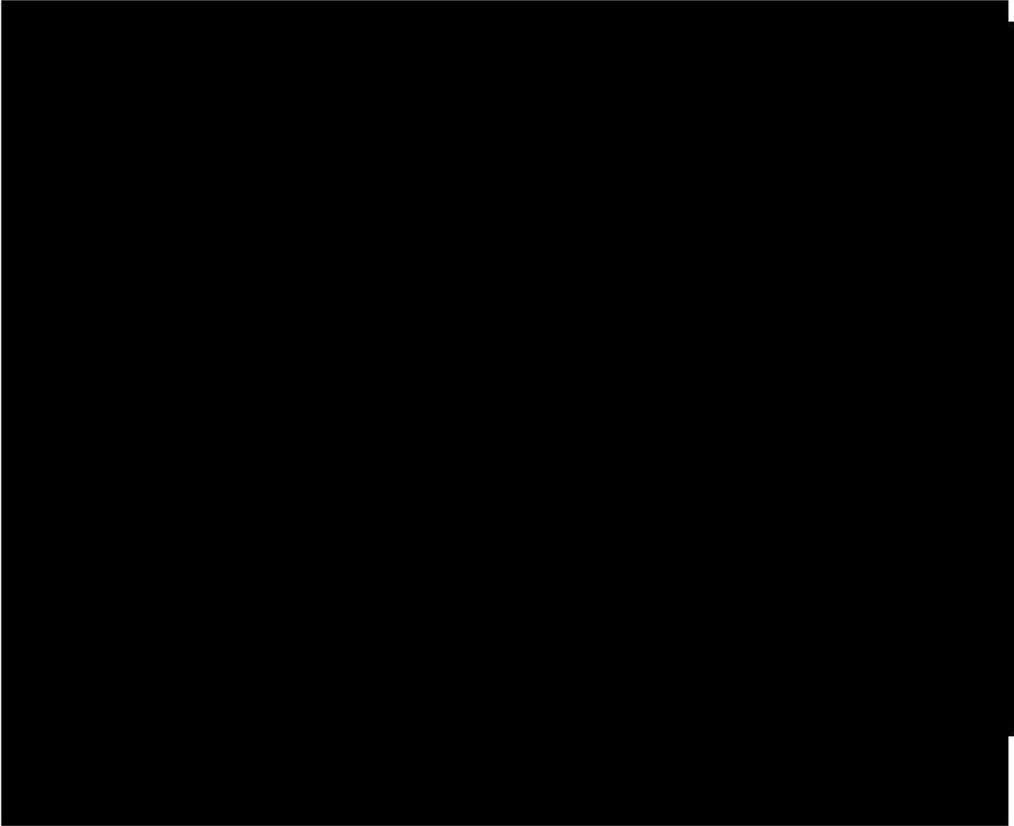
#### 4.10.13.2 Assumptions

The Transitional Preferred Option involves a direct swap of electric and gas boilers at initial project build-out. Technical changes to the proposed scheme are localised at the Parkside Pools Energy Centre.

For the purposes of the techno-economic modelling, the following assumptions have been made:

- Required boiler capacity & heat fractions does not change vs the base-case.
- The energy centre has sufficient space for interim gas boiler installation (£2.3m including flues and ancillaries), which is later replaced by electric boilers in 2045.
- £1.5m cost assumed for a local gas connection (requires validation with Cadent)
- The required electrical capacity is available (inc. grid upgrades) for transition to electric boiler top-up in 2045. Total cost is equivalent to base-case (£14.4m), but with proportion delayed until gas boiler replacement date.
- Gas import costs aligned with DESNZ Green Book retail price trajectory.
- **No changes to connection charges and heat tariffs vs the base-case** – costs to customers remains anchored to a full-electric counterfactual as per Section 4.10.3. It is recognised that a re-baselining may be required to set an alternative, lower heat tariff across the first 15-years of operation (2030-45) to reflect gas contribution in the counterfactuals. For this stage of analysis, revenues remain unchanged for a direct comparison of the economic impact on costs only, however in the Financial Case potential reductions in connection charges and heat tariffs are investigated.
- **GHNF funding remains at █████/kWh** of 15-year delivered heat – in practice, IRR limitations may throttle the total funding available from the GHNF. This potential impact is assessed in the Financial Case where funding is reduced to 2.1p/kWh to ensure the project pre-grant IRR remains within an acceptable range.





#### 4.10.13.4 Carbon Impact

The Transitional Preferred Option has been assessed for its carbon emissions against the Business as Usual and Ambitious Preferred Option base-case.

The results in Table 4—34 demonstrate that although the interim gas boiler operation results in more than double the operational carbon compared to the fully electrified counterpart, this is nevertheless a comprehensive reduction of 93%, or 506,000tonCO<sub>2</sub>e, over the 40-year project lifetime vs. the Business as Usual.

The carbon factor of the project in the year 2030 is 76gCO<sub>2</sub>e/kWh, which remains well within the 100gCO<sub>2</sub>e/kWh GHNF carbon gate eligibility criteria.

Given the significant economic benefits detailed in Section 4.10.13.3, the relatively minor reduction in carbon savings is considered an acceptable trade-off in the Preferred Option whilst still satisfying the overarching long-term decarbonisation ambitions of the business case.

**Table 4—34 Ambitious vs Transitional vs BAU carbon summary**

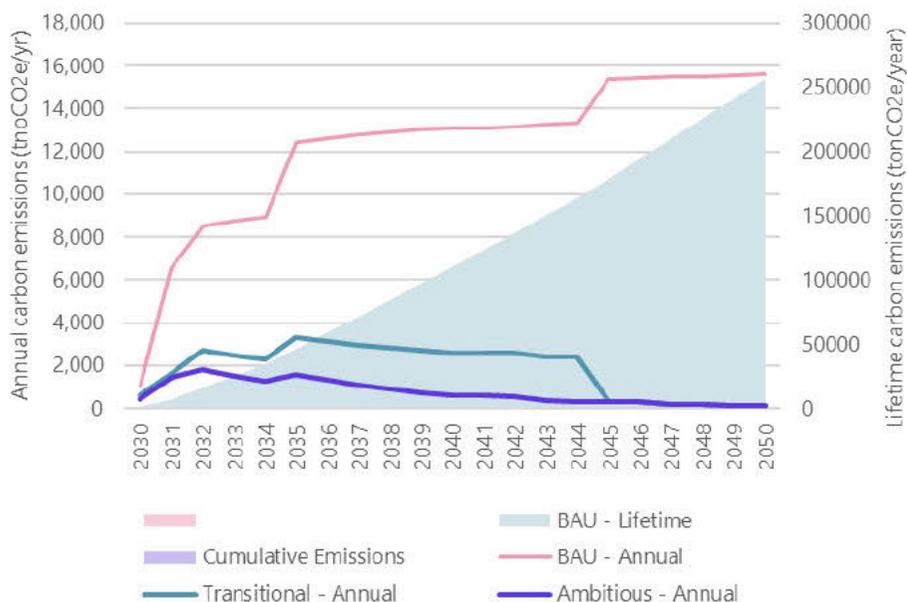
| Parameter                  | Unit                    | BAU     | Ambitious Preferred Option | Transitional Preferred Option |
|----------------------------|-------------------------|---------|----------------------------|-------------------------------|
| 40-year carbon emissions   | tonCO <sub>2</sub> e    | 546,000 | 17,400                     | 39,900                        |
| Emission reduction vs BAU  | tonCO <sub>2</sub> e    | -       | 528,600                    | 506,100                       |
| Emissions reduction vs BAU | %                       | -       | 96.8%                      | 92.7%                         |
| Annualised carbon factor   | kgCO <sub>2</sub> e/kWh | 0.215   | 0.007                      | 0.016                         |

#### 4.10.13.5 Social Impact

The 40-year social NPV and IRR of the Transitional Preferred Option are shown against the economic NPV and IRR in Table 4—35 – the Social IRR remains well-within GHNF minimum thresholds of 3.5%, and actually represents an uplift vs the fully electrified case due to the improved economic performance of the scheme, which outweighs the decrease to carbon abatement/air quality improvement.

**Table 4—35 Transitional Preferred Option TEM social impact**

| Parameter  | Units | Transitional Preferred Option – Pre-GHNF | Transitional Preferred Option – Post-GHNF |
|------------|-------|--|---|
| NPV        | £m    | ■  | ■   |
| IRR        | %     | ■  | ■   |
| Social NPV | £m    | ■  | ■   |
| Social IRR | %     | 20.5%                                    | 47.9%                                     |



**Figure 4—24 Ambitious vs Transitional vs BAU carbon trajectory for first 20 years**

## 5 Commercial Case

### 5.1 Procurement & Commercial Strategy

Amberside Advisors has developed a commercial case through several workshops with the Council and Strategic Partners, ascertaining the key drivers for the project. The aspects of the commercial case that have been developed through this process are the **commercial structure**; the ways in which the project can be structured for viability and to secure the procurement strategy necessary for delivery, the steps towards financial close. The **funding options** for the Council and Strategic Partners (both public sector and private sector), the **recommended procurement strategy** and next steps after the completion of the OBC.

The initial commercial workshop in February 2025 contextualised and explained the pros and cons of the range of commercial models available to the Council and Strategic Partners, exploring roles and responsibilities as well as understanding the impact of the different levels of control, risk and reward enabled by each commercial model. The first workshop agreed a short-list of commercial models which included a Concession, Co-investment Joint Venture, and a Local Authority-led model. The second commercial workshop in November 2025 brought together the conclusions of the work on the Techno-Economic Model and overview of potential funding options to determine the preferred structure. This was agreed to be a 51:49 Co-investment Joint Venture between Cambridge City Council (51%) and some Strategic Partners (49%), [REDACTED]. This structure would be supported by a Design, Build, Operation and Maintenance (DBOM) partner to be procured from private sector specialist suppliers by the JV. The JV would also likely need to hire an experienced leadership team to manage the DBOM contract, discharge the duties of the Heat Network Company in line with Ofgem regulation and deliver the strategic aims of the investors through the operations of the Heat Network Company.

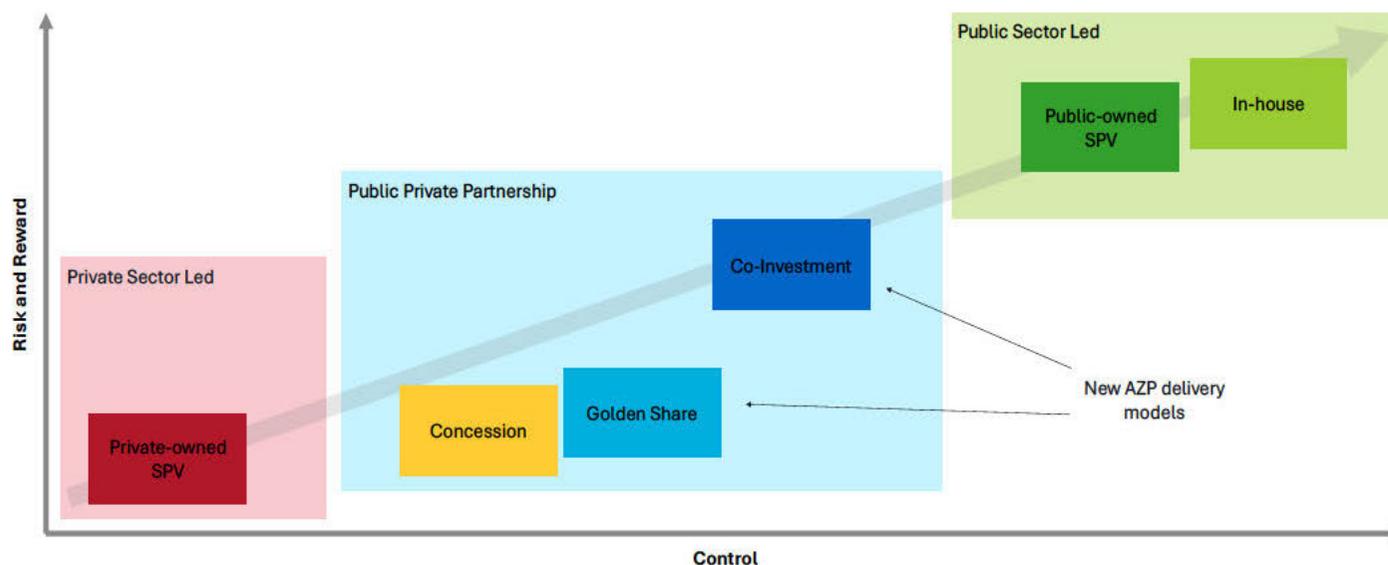
During these workshops and the surrounding work, extensive stakeholder engagement has been conducted with all Strategic Partners including: Cambridge City Council, the University of Cambridge, 17 City Centre University of Cambridge Colleges, and Anglia Ruskin University. The Strategic Partners have been involved throughout the development of the project, agreeing the Critical Success Factors of the project in January 2025 and feeding into the decision-making process. These Strategic Partners will form the initial group of customers of the heat network (and all customers envisaged in the Minimum Viable Product are Strategic Partners), and the recommended commercial structure divides this group into Investing Strategic Partners [REDACTED] and Non-Investing Strategic Partners [REDACTED].

#### 5.1.1 Commercial Strategy

In recognition of the Council's role as lead facilitator, and ability to access public financing, the risks, reward and control have been evaluated primarily from the Local Authority's perspective, with recognition of prospective third-party investor and developer perspectives. In the first Commercial workshop, Amberside presented the spectrum of commercial structures available to the Council for a heat network project and discussed openly the Council's preferences with regards to risk and control. The relative risk, reward and control levels refer to those of the Council predominantly, and secondly to the other investing Strategic Partners in the Co-investment option. Figure 5—1 provides a high-level overview of these commercial models in relation to risk, reward and control, showing that typically as control increases so do the levels of risk and reward, though it should be clear that this is indicative, relative, and is ultimately dependent on contractual agreements. Other commercial models are sometimes used but were not raised in the commercial workshops and will not be covered here. The models exist on a spectrum and are not necessarily mutually exclusive – for example, a Joint Venture (JV) partnership is often procured under concession regulations and may include Concession Agreements (see below for a summary of Concession Agreements).

The six delivery models in Figure 5—1 can be grouped into three archetypes:

- Private Sector Led – the private sector typically designs, builds, finances, operates and maintains the project, with limited to no Council involvement during operations
- Public Private Partnership – the Council either tenders a Concession, has a “special/golden” share or ordinary shares in the project company and a seat on the board
- Public Sector Led – the Council independently delivers the project, either setting up a Special Purpose Vehicle (SPV) to own and operate the heat network or owning and operating the heat network in-house



**Figure 5—1 Commercial Delivery Model Overview in relation to risk, reward and control**

Having discussed these commercial structures with Cambridge City Council and the Strategic Partners, the key takeaways and thus the Critical Success Factors (CSFs) for assessing the recommended commercial structure were as follows:

- Primary CSFs
  - Help decarbonise individual Estates whilst enabling potential future heat network expansion
  - Provide cost-competitive and reliable low carbon heat – offer low carbon energy that is better value over contract lifetime against counterfactual(s), provide long-term reliability and as a minimum, provide heat supply availability in line with industry standards
- Secondary CSFs
  - Maximise social value and education

- Minimise disruption and share the benefit from construction across the city
- Showcase sustainability leadership and innovation

The first commercial workshop in February 2025 established that the Strategic Partners were seeking a level of control in project delivery which ruled out the Private sector-owned SPV and Joint Venture Golden Share approaches. The three commercial models shortlisted after the first commercial workshop in February 2025 were as follows:

- Concession
  - Often an off-balance sheet option to mitigate capital expenditure limitations on public sector bodies through a Public Private Partnership
  - Such an agreement allows the Strategic Partners to hold a private sector developer to account on key contract requirements (e.g. cost competitive tariffs, resilience and futureproofing)
  - The Council can take ownership of the network at the end of the Concession period
  - The public sector brings the baseload (as a customer) but does not need to provide a shareholding
  - There can be limited control and restrictions as per agreed commercial arrangements
- Joint Venture: Co-investment
  - The Strategic Partners can take a more influential role in the development of the heat network to meet CSFs
  - Co-investment could reduce investment requirement from the Council and funded with support from NWF
  - The model also brings some potential financial returns for the Council and investing Strategic Partners but in return for taking risk (in normal commercial circumstances)
- Public Sector-Led: Public Sector-Owned SPV
  - This gives the Council control but also all the risk and capital costs
  - This model requires the Council to have capacity to run an energy company (a regulated utility) with the commercial and operational management expertise, working capital, and administration and governance resources
  - It could be funded with support from NWF
  - An SPV provides an easier exit strategy, potentially following completion of Minimum Viable Product (MVP)
  - Ultimately, the Council expressed their concerns regarding full risk exposure, stating a preference for a shared risk model such as a Joint Venture. As such, the wholly Public Sector-led model was not taken forward beyond the workshops.

## 5.1.2 Shortlisted commercial delivery models

### A: Concession

Under a concession delivery model, the project sponsor typically grants a private sector supplier (concessionaire) an exclusive right to provide services within a defined area and period (the Concession period) through a Concession Agreement. In return, the concessionaire usually designs, constructs, finances and operates the heat network according to the Agreement. Importantly, the concessionaire takes on the financial risk of generating an acceptable IRR.

In normal circumstances, Concession agreements are tendered by a Sponsor, typically the council (although an alternative approach could be applied to the CCCHN Strategic Partners). The sponsor may set out the extent of the heating services to be provided through the concession agreement, including performance standards, heat tariffs and heat offtakers. Meanwhile, the concessionaire finances the project, recouping its investment through income generated from customer connection charges (usually determined by the private sector supplier) and heat sales.

The concessionaire may source funding from third parties and/or public sector grant schemes but must take on the financial risk associated with developing the network. This approach may require the sponsor to undertake more development work prior to going to market to prove the viability of the scheme. This is because it is taken on by the private sector.

The Council can establish controls through the terms of the Concession Agreement, including a performance regime to ensure the concessionaire is delivering services to an appropriate standard, price controls and profit-share mechanisms. The Concession Agreement will also define the terms under which it may be renewed, extended or terminated. Upon expiration or early termination of the Concession Agreement, there can be mechanisms for step-in and/or asset hand-back procedures, with responsibility and ownership (depending on the structure) usually reverting back to the council. This process is usually subject to a retendering event.

This approach suits the Council in that it allows the Council a level of control over key matters through the Concession Agreement without the need to be actively involved in delivery, provide funding and take on risk for the project during the Concession period (though the assets typically revert to the Council upon expiration and there may be some profit share mechanism). However, it provides less control for the Council and Strategic Partners than a Joint Venture.

Indicative structure diagrams and pros and cons tables are included in Appendix U.

#### **High-Level Case Study – Queen Elizabeth Olympic Park (QEOP) and Stratford City Community Energy Network**

**Structure:** Concession Agreement between Olympic Delivery Authority (plus sponsoring real estate company(s)) as the Supervisory Body and ENGIE (nee GDF-Suez), under a 40-year agreement to design, finance, construct and operate the energy scheme.

#### **Why was this structure chosen?**

The structure allowed QEOP and Stratford City meet their heat demand by ENGIE's >£100m investment in time for London 2012, achieving competitive energy prices and facilitating carbon reduction targets.



#### **Key Contracts and Agreements**

Under a concession, there are several key agreements that the sponsor (assume the Council in this instance) will have to enter into with the incoming ESCo, as the project sponsor and as a major customer. The key contracts are detailed below:

- Concession Agreement – this lets the opportunity. It includes standard representations and warranties, concession obligations (i.e. details of the design, build, financing, operation and maintenance services to be provided), a performance regime and appropriate property rights and licences e.g. a form of lease for an energy centre and easements for networks with titleholders.
- Connection Agreement(s) – this would be between the ESCo and customers (e.g. colleges) for any given connection and will cover the physical connection of the heat network to a block requiring heat supply sometimes including adoption of internal Secondary.
- Supply Agreement(s) – energy and heat can be supplied to different types of customers through Supply Agreements, including commercial customers (e.g. colleges), and as the network grows extended to bulk customers (e.g. private student accommodation), domestic customers and Residential Social Landlords (RSL). Supply Agreements will typically include terms relating to the heat supply and ancillary services, such as the provision of heat to be made available within the operating parameters and typically aligned to Heat Trust Scheme Rules (to be replaced by Ofgem Regulations in 2026) for residential (and microbusiness) customers.

## **B: Joint Venture: Co-investment**

Under a traditional Co-investment model, the sponsor partners with a delivery and funding partner (or partners) to develop the heat network proposed. The sponsor and delivery and funding partner(s) co-invest – either capital or contributions in kind – in a new Energy Services Company (ESCo), which may also take on third-party debt and/or seek grant funding to improve project economics. The new ESCo is the owner of the heat network assets and is responsible for the design, construction, financing and operation of the heat network. The financial returns (or losses) are shared according to the parties' respective equity investments.

The shareholders and ESCo will be governed by a Shareholders' Agreement which outlines rights and obligations of the parties involved. It will allocate voting rights and board representation, specify a list of Reserved Matters, detail rules for the transfer of shares and outline procedures for exiting or dissolving the Joint Venture.

Several alternative approaches have been explored by the project team under the Joint Venture Co-investment model. There are two key points of differentiation: 1) whether the Joint Venture partner has heat network development expertise and capability, 2) whether the Council has an overall majority (and therefore control). The specific Joint Venture Co-investment structures considered are:

- Joint Venture with private sector developer (funding and delivery Joint Venture)
- 50:50 Joint Venture between Council and Strategic Partners (funding Joint Venture)
- 51:49 Joint Venture between Council and Strategic Partners, with Council as majority shareholder (funding Joint Venture)

The Critical Success Factors determined that the lowest customer tariffs were preferred. The Strategic Partners agreed that in order to secure control on tariffs, the preferred Joint Venture structure would see a combination of Strategic Partners as equity investors. It was considered that a Developer-Investor would be motivated to offer competitive tariffs, not necessarily the lowest possible and may have a higher cost of capital. Council involvement could help the project to access alternative sources of capital including National Wealth Fund debt. As such the preferred Joint Venture structure would require the Council to have a simple majority ownership of the Joint Venture, to access the best terms from NWF, so a 51:49 Joint Venture with the Strategic Partners was selected for further analysis.

The Joint Venture model offers more control to the Council and Strategic Partners but requires greater buy-in of the expertise to deliver the project – from procurement through to operation. This can be framed as the cost of control and is explored further in the preferred option section.

Indicative structure diagrams and pros and cons tables are included in Appendix U.

## Key Contracts and Agreements

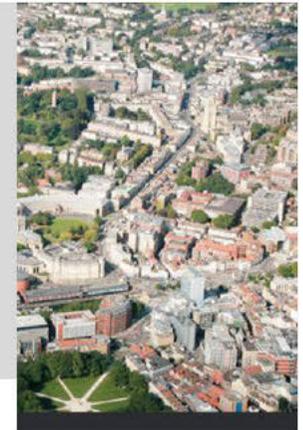
Under a Joint Venture, the joint venture partners need to create two entities, one responsible for the delivery of the network and an operating entity with which customers will contract. Under the proposed model, both Design & Build and Operation & Maintenance services would be sub-contracted, so separate contracts will be required under this model. The key contracts are detailed below:

- Joint Venture Agreement – to define the collaboration between two or more shareholder entities to lead the heat network project, share risks, and pool resources for the project. This is required for each legal entity established under the JV. Establishes the contract between a company's shareholders detailing their rights and obligations, ensuring clarity over long-term governance.
- Connection Agreement(s) – this would be between the project special purpose vehicle and individual customers for any given connection and will cover the physical connection of the heat network to a block requiring heat supply (as set out above under 'Concession')
- Supply Agreement(s) – as set out above under 'Concession'
- Services contracts with ESCo supply chain including design, build, operate, maintain and replace, metering and billing and any other specialist subcontractors (and relevant advisors) which will likely include a performance regime which will govern performance requirements (and KPIs). This may also include a specialist PMO function to provide management services.

### High-Level Case Study – Bristol City Leap

#### Structure:

- City-wide Strategic Energy Partnership procured by Bristol City Council (BCC)
- 50/50 Joint Venture between Ameresco and BCC to deliver >£500m investment in energy infrastructure and efficiency projects
- Vattenfall Heat UK acquisition of Council-developed Bristol Heat Network assets (and staff transfer) with retained Golden Share
- 20-year Concession governing projects including expansion of heat network across BCC estate



### **Case Study – Newcastle Regenerate Partnership (2018 close)**

- Transaction value: Up to £500m capital expenditure (40-year Partnership to develop)
- Newcastle City Council procured ENGIE Group as its strategic energy delivery partner. The procurement anticipated a wide range of services, primarily (but not limited to) district energy schemes, with the first scheme to be the development, delivery and operation of the Science Central (Helix) scheme. This is a circa £20m CHP-gas scheme supplying heat, cooling, and private wire to the surrounding Council, University, and L&G office developments for the initial phase (with further growth since).
- Helix was delivered pursuant to that partnership under an AssetCo SPV (majority owned by Council) to fund and own the assets, which then lets the services contracts through a SupplyCo SPV. This reflected the respective roles, risk allocation, and level of funding (including European Regional Development Funding, and Local Growth Deal funding through the NE LEP) provided by each of the parties.
- This is also an example of a multi (more than 2) party Joint Venture. The number of parties made governance and decision-making exponentially more challenging. The shareholders and the JV require separate advisors (e.g. legal) to avoid conflicts of interest. This means transaction time and costs are inevitably significantly higher, as well as the ongoing financial and commercial management of the SPV itself.
- This example also used an unbundled structure between Asset holder and the operational/supply vehicle. This has several ringfencing benefits including ultimately the ability for AssetCo to change the operational/supply provider.
- A key lesson learned is that simplified structures are more efficient – in this example, it would have more efficient for the AssetCo to contract to the 100% private EScO (rather than JV SupplyCo SPV). It is also especially important to ensure that risk allocation is determined and agreed specifically between the parties, especially in relation to potential construction period overspend.

## **5.2 Funding options**

### **5.2.1 Public Sector Funding Options**

Inherently, heat network schemes require significant amounts of upfront capital costs. Thus, it is likely that, regardless of whether the Strategic Partners or a Third-Party EScO would be financing the project, some public funding is likely to be needed to support the project to keep the cost of capital affordable to energy users. There are several different public sector-specific funding options available to the Council. However, the key schemes that will have the greatest chance of success and will have the greatest impact on the market attractiveness of the project are the Green Heat Network Fund (GHNF) and the National Wealth Fund (NWF).

### **5.2.2 Green Heat Network Fund (GHNF)**

The GHNF is a multi-year £485 million capital grant fund (succeeding the £320m Heat Network Investment Project) that supports local authorities and energy companies with the construction and commercialisation costs associated with heat networks. It is designed for new low and zero carbon heat networks, as well as the retrofitting and expansion of existing heat networks. GHNF has several gated metrics to provide funding, the most relevant for this project to consider are:

- Carbon gate – The carbon intensity of the network must be no greater than 100gCO<sub>2</sub>e/kWh of thermal energy delivered. However, there is a 5-year grace period, and so phasing should be considered accordingly.
- Capped award –whilst the official guidance from GHNf states that 4.5p of grant/kWh delivered (over the first 15 years of operation) is the upper end of the total grant that can be received, the latest guidance indicates that due to significant competition for the scheme, [REDACTED]
- For the purposes of modelling the options in the Economic Case an assumed GHNf grant of [REDACTED]/kWh has been used – this was refined through later modelling to a capped award of 2.1p/kWh, as used in the Financial Case.

To make a competitive application, delivery risks should be mitigated and win themes clearly identified. Based on a thorough analysis of the guidance for Round 10 and the feedback at the round 10 application guidance webinar, the following actions can be taken to ensure the best chance of success (in order of importance):

- Thoroughly engage with heat sources and customers early and communicate expected tariff structures to secure Letters of Support or Heads of Terms. Early engagement demonstrates project deliverability and mitigates demand risk. This quality of stakeholder engagement is assessed on a 1 – 11 scale.
  - This is a strength of the proposed project as all customers are Strategic Partners who have been heavily involved in the development of the project up to its current stage. There is an opportunity to submit a very well supported GHNf application with extensive Letters of Support from Strategic Partners. This could be strengthened further by securing agreement to indicative Heat Supply Heads of Terms but this is not essential to a successful GHNf application.
- Know where funding for remaining capital costs comes from. Round 10 has introduced additional emphasis on where the funding for the remaining 50% of commercialisation and construction funding comes from, and there is an additional section in the Main Application Form that specifically asks for information on funding sources. Soft market testing can help to identify funding sources.
  - There has already been a high level of engagement with the NWF, and the building in of this funding source to financial modelling work is beneficial to this element of the application.
- Flag technical or commercial risks that may affect the development of the proposed network and take convincing steps to mitigate them. This should be fed into the GHNf risk register. Evidence of successful engagement with landowners/rights holders where pipe passes through can really help to mitigate risks (e.g. highways etc).
  - Again, engagement and support from the Strategic Partners, who will also be landowners of significant portions of the area the network covers, supports risk mitigation here, as does additional engagement undertaken
- Market Transformation Commitments are increasingly important to GHNf applications. Sharing the lessons learned during the commercialisation and development of the heat network is vital.
  - This is where integration of the CSF around maximising social value and education is particularly important, and this condition should be supported by the University of Cambridge’s standing as an educational institution combined with its role as a Strategic Partner of the project.
  - Work already underway includes developing the Proof of Concept for a Heat Network Digital Twin as a strategic solution, which builds upon both the strength of the Strategic Partnership and Cambridge’s academic prowess with two leading universities - University of Cambridge and Anglia Ruskin University.
- Understand the strategic and commercial value of your heat network. DESNZ are looking to fund ambitious projects with significant expansion opportunities and future connections that enable zonal-scale heat networks. It is recommended that the optional evidence “2.2 Future expansion potential note” is completed.
  - The separate Zoning Study has identified extensive growth opportunities for the network which align well with this part of the GHNf requirements, which is likely to help strengthen an application.

The Council could apply for the grant directly and pass it on to the development vehicle through a Provisional Award mechanism or allow a chosen investor to apply on their behalf. There are pros and cons of each approach, however given the potential time constraints for getting the application submitted, the Council applying themselves would be the preferred route. This amount could then be on-granted to the project vehicle.

### 5.2.3 National Wealth Fund (NWF)

Formerly UKIB, the National Wealth Fund has allocated £4 billion for local authority projects across 5 key areas including clean energy. This includes a specific District Heat Network strategy (published in 2023) seeking to address policy risk, revenue risk, market immaturity and project economics (especially in relation to the balance between electricity and gas prices). In the development of this Outline Business Case, the opportunities presented by National Wealth Fund loans to local authorities at concessional rates have been considered extensively. Additional products offered by NWF include a Connection Fee and Secondary Works facility and (for private-sector-led projects, patient equity).

The minimum ticket size for a loan from the National Wealth Fund is £15 million for Local Authorities, offered for up to 50 years, and £25 million for Private Sector entities.

Any Connection Fee facility would also require a minimum drawdown of £15 million but is based on a shorter-term tenor and associated gilt rate (understood to be 5-10 years).

An Early-Stage Debt Facility is also available which helps to overcome key barriers such as construction/ramp-up risk and reliance on connection charges by providing repayment flexibility until revenue streams are sufficiently stable to service the debt.

In developing the outline business case, the concessional rate offered to local authorities to on-lend to projects in which they hold a majority equity stake has been assumed at Gilts + 40bps.

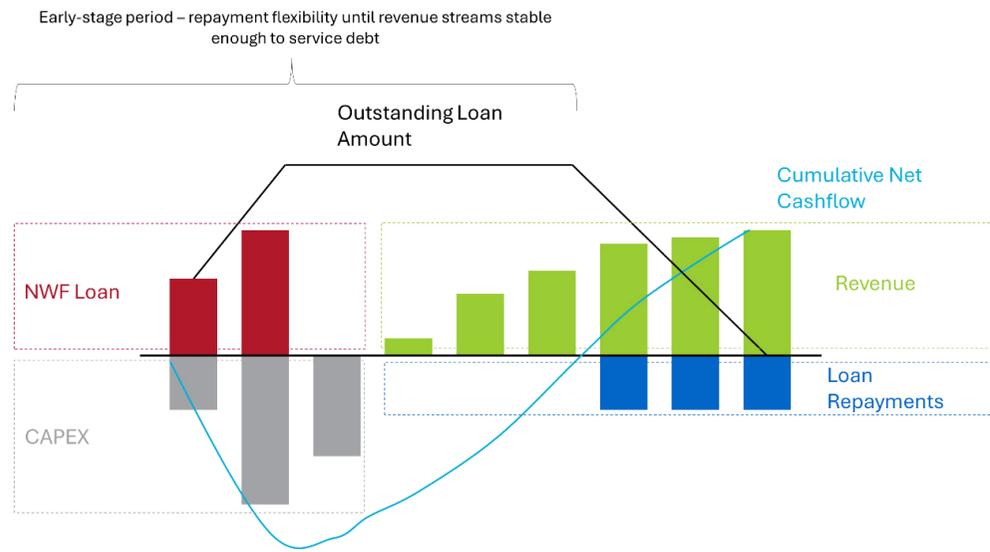
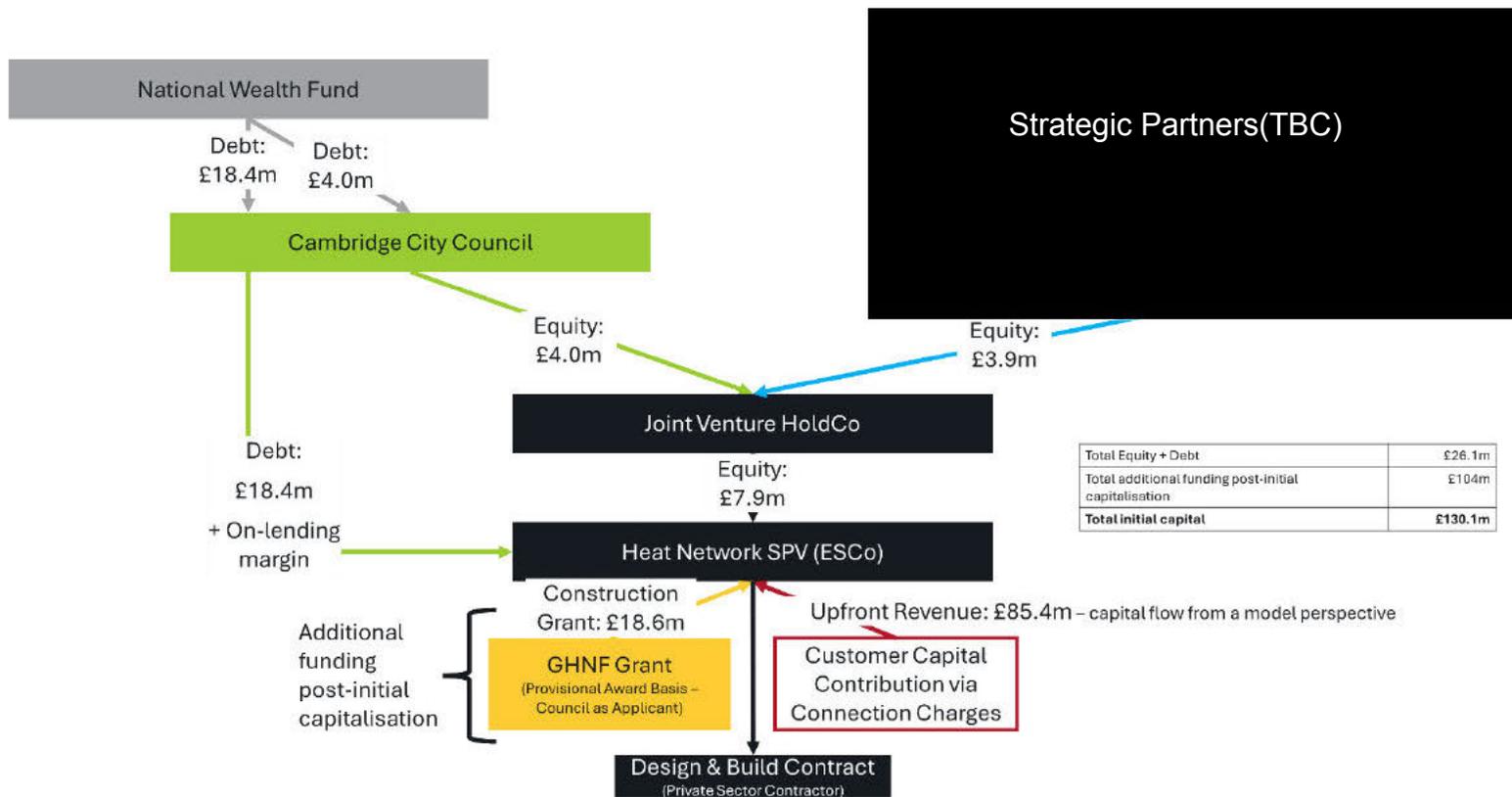


Figure 5—2 National Wealth Fund Flexible Debt Model





**Figure 5—3 Indicative Capital Structure of Preferred Option**

The debt funding risk is assumed to sit with the Council, which is reflected in the Council's on-lending premium.

A significant factor in considering the commercial case for the Cambridge City Centre Heat Network is the unique and differentiating involvement of the initial offtakers in the Detailed Project Development process. Regardless of the Strategic Partners' intention to invest in the project, the enabling role the Strategic Partners have played has the potential to make this project uniquely attractive to third-party investors, considering the longevity of the institutions which make up the initial offtakers and their associated creditworthiness. This is contingent however on the commitment of the Strategic Partners to be customers of the network in its initial Minimum Viable Product (MVP) stage. However, the success of the network depends on all customers connecting and therefore customer buy-in is essential. This has been expressed as an upfront capital contribution through the connection charge.

It is worth noting that regardless of structure, ultimately, the ability of the project to raise capital (equity and debt) will be largely dependent on the level of commitment of the offtakers to connect to the heat network. The strength of this commitment will support a GHNf application and make the case to prospective investors more compelling. Confidence in offtakers can enable investors to consider a reduced revenue risk, supported in this case by the long-established nature of the offtakers. There is a greater opportunity for lower connection charges and tariffs where confidence in the offtakers likelihood of connection is high.

In selecting the preferred option of a 51:49 Joint Venture, it has been noted that the project may also be deliverable through the Concession model solely by the private sector, who may approach this project differently if given the relative freedom of an output specification concession, taking into account the growth potential and level of commitment of offtakers (reduced risk to project revenues) – they may be able to reduce the capital cost requirements based on design optimisation, with a knock-on impact on the heat tariffs.

### 5.3.1 Potential for risk transfer

Risk transfer is applicable to all stages of project development. Each stage in project development is a point where residual risk is assessed and transferred. When allocating parties to undertake different roles of heat network project development, a key objective should be to allocate risk to those most able to manage that risk. Opportunities to manage risk include form of funding, project development time, design, operational risk.

The Design & Build Contract should include provisions to address the following categories of risk: ground conditions, consents and planning, inflation and force majeure events. The Operation and Maintenance Contract should include provisions to address operational resilience, continuity, energy procurement, management, trading and pricing strategy, disaster recovery plans, labour (and materials) inflation, lifecycle funding, energy supply, metering and billing, and customer services. There should be appropriate KPIs to assess performance and associated liquidated damages relevant to underperformance.

### Commercial Risks and Opportunities

A more extensive assessment of project risks and mitigations is set out in the Management Case. The key commercial risks and opportunities identified below reflect the development work to date undertaken with Strategic Partners:

|   |   |
|---|---|
| <p><b>Customer Buy-in &amp; Contributions</b></p> | <ul style="list-style-type: none"> <li>• The pool of customers identified are essential to the successful delivery of the project. Securing sufficient buy-in to progress the project is a key risk to the project. This buy-in is proposed in the form of the upfront capital contributions from customers (Advance Connection Charges).</li> <li>• There is a proposed pain/gain share structure for Connection Charges in the event of budget over/under spend to provide additional risk sharing, with some potential shared upside in the event that a managed underspend can be delivered on the construction budget.</li> <li>• Advance Estimated Connection Charges are positioned relative (with a discount from) the low carbon counterfactual solutions for each customer (detailed in the Economic Case).</li> <li>• As part of the customer buy-in balance between gas and electricity pricing must also be communicated and understood, to provide the full counterfactual costs with some context relative to the gas business as usual arrangements.</li> </ul> |
| <p><b>Capital Structure</b></p>                   | <ul style="list-style-type: none"> <li>• The proposed capital structure is reflective of the unique project opportunity and seeks to balance the needs of all Strategic Partners.</li> <li>• Concessional Rate debt investment in the project from National Wealth Fund via the Council is envisaged to reduced costs to customers. However, the risk to achieving low-cost debt in the project through this route is dependent on the on-lending margin agreed to ensure compliance with subsidy control regulations (for which further specific advice is required at the Commercialisation stage).</li> <li>• GHNH Grant also provides substantial funding during the construction phase, with success in securing this grant not guaranteed due to the competitiveness of the grant scheme.</li> </ul>  |

|                                       |  |
|---------------------------------------|--|
| <b>Construction Budget Management</b> | <ul style="list-style-type: none"> <li>• There is a project risk of overspend, especially due to ground condition unknowns (such as archaeology).</li> <li>• This risk is greater as the proposed investors/sponsors are not experienced heat network developers, increasing the risk of contract management inefficiencies which would affect equity returns.</li> <li>• Additional costs have been included to cover expenditure on the team at an SPV level to include Non-Executive Director(s) (to provide strategic insight and guidance, a Company Director (experienced in contract management), a Contracts Manager, and an administrative and accounting team (to support both construction and operation phases). In addition, during construction, a team of consultants will support the SPV in contract specification and management, fulfilling roles such as the Employer’s Engineer.</li> <li>• Alternative delivery models may see lower direct SPV costs for these services as developer-led equity investors bring more experience and capability to such a project. This is one aspect of the cost premium for securing long-term control of the heat network.</li> </ul> |
| <b>Contractor Risk Appetite</b>       | <ul style="list-style-type: none"> <li>• Not all development risks are likely to be absorbed by the Design &amp; Build (D&amp;B) Contractor – unlike in a JV with an experienced Heat Network Developer where through the equity co-investment, the developer takes more risks than a contractor would usually accept.</li> <li>• There is a possibility that a contractor would accept additional risks, including through a pain/gain share but there would usually be a trade-off with the pricing of the contract.</li> <li>• The extent to which D&amp;B contractors would be prepared to accept project risks through a fixed price contract will be further explored during the initial Soft Market Testing, and developed through the Pre-commercialisation phase</li> </ul>   |
| <b>Growth Opportunities</b>           | <ul style="list-style-type: none"> <li>• The Zoning Study highlights the considerable opportunities to expand the minimum viable product (MVP) network across the city and deliver increasingly strong returns to investors. This may also provide sufficient attractiveness in the market to support a partial divestment to bring in private sector expertise and capital to support a network expansion once the MVP is operational.</li> </ul>   |

### 5.3.2 Procurement options

The preferred option requires a Design, Build, Operations & Maintenance (DBOM) contractor with provision for Metering and Billing. These contracts should be held and managed by the ESCo through the management team (FTE Director and 1 FTE Contracts Manager), supported by the consultancy team (legal, commercial, financial, technical) performing the Employer’s Agent and Owner’s Engineer functions (the costs for which are included in the project costs, set out in the Financial Case).

The next phase of the project (Pre-commercialisation) should establish the procurement strategy, but given the Council majority in the structure, this is likely to conform to existing Council procurement policies. The preparation of the procurement processes and subsequent contracts should consider the appropriate Key Performance Indicators (KPIs) against which the contractors work would be assessed and the milestones expected to be achieved.

### 5.4 Soft Market Testing Results



## 6 Financial Case

### 6.1 Introduction and overview

Amberside have produced a financial model in the DESNZ template to assess the affordability, funding and financial viability of the preferred project technical option and delivery model.

As the preferred technical solution included in the financial model relies on top-up heat to achieve peak heating requirements from gas boilers, the model includes the assumption that once these boilers reach the end of their useable life, they will be replaced with electric boilers to help to project reach the decarbonisation target. It is assumed through the modelling that the investment required to fully electrify the system will be delivered as a separate and lower risk equity investment (currently envisaged to be made in Year 18 of the project).

As configured, the model shows a Nominal Equity IRR of 12%, which assumes a GHNF grant is secured.

### 6.2 Financial Model Development

In preparation of the financial model, base assumptions were originally derived from the Techno-Economic Model (TEM) produced by Buro Happold. This provided inputs to the financial model including CapEx, RepEx, OpEx, phasing, initial tariff assumptions, demand and all technical assumptions such as Coefficients of Performance (CoPs) and efficiencies.

In developing the Financial Model, Amberside Advisors applied project-level assumptions through engagement with the Strategic Partners and macro-economic factors including SPV management costs, tax assumptions for an SPV, accounting, financing and indexation. Project revenues (fixed and variable tariffs and Connection Charges) and GHNF Grant have been revised through engagement with Strategic Partners to provide a full financial overview of the project and calculate return metrics and sensitivities.

To inform the selection of the preferred delivery model, several different options were assessed through the Financial Model (including a wholly council-owned, variations of JV structure and a Concession), for both a fully electrified solution and the gas top-up technical solution. The technical option and commercial delivery model set out in this Financial Case reflects the Preferred Options agreed with the Strategic Partners.

Key outputs from the TEM include the initial assumptions for project revenues (Connection Charges, Fixed and Variable Tariffs), GHNF grant funding, customer connections (including timing and heat demand), energy centre and network costs and useful lifetimes, heat generation and energy consumption. The TEM approach to CapEx estimates is conservative and has been supported by cost consultants. It has not yet been tested through a competitive process and therefore may not reflect fully the approach taken by a developer. The CapEx also includes a risk-related uplift on some items, and 15% base contingency applied to the total. The TEM uses counterfactuals to determine an initial benchmark for Connection Charges and tariffs.

The financial model applies macro-economic factors (such as inflation), a 4-year rolling RepEx Sinking Fund (to ensure future RepEx is paid from project revenues and supports a higher valuation at potential exit), financing scenarios and tax assumptions to derive post-tax and post-grant nominal IRR and NPV as the key return metrics for both the Council and third-party investors. It is assumed in the modelling that the project SPV will pay Corporation Tax on profits at 25% - it is recommended that specialist tax advice is taken during Commercialisation. The impact of these factors is that the Financial Model reports outputs in a different price base to the TEM, which is reflected in Table 6—1.

Table 6—1 Summary of impact of macro-economic factors and financial modelling assumptions on TEM Outputs, expressed over the 40-year project timeline

| Key Metric         | 40-year TEM Value<br>(Real 2025 prices,<br>3.5% Real Discount Rate) | 40-year Inflated TEM Inputs<br>(Nominal prices <sup>2</sup> ,<br>12% Nominal Discount Rate) | 40-year Financial Case<br>(Nominal Prices,<br>12% Nominal Discount Rate)<br>incl. increase in OpEx per Table 6—2<br>and Revenues to target IRR |
|--------------------|---|---|--|
| ██████████         | ██████████  | ██████████  | ██████████   |
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In addition to macro-economic factors, through engagement with the Strategic Partners, the management costs for the Design, Build, Operation & Maintenance, and Metering and Billing contracts were also included in the Financial Model as show in Table 6—2 below.

Table 6—2 Additional Contract Management Costs Included in Financial Case

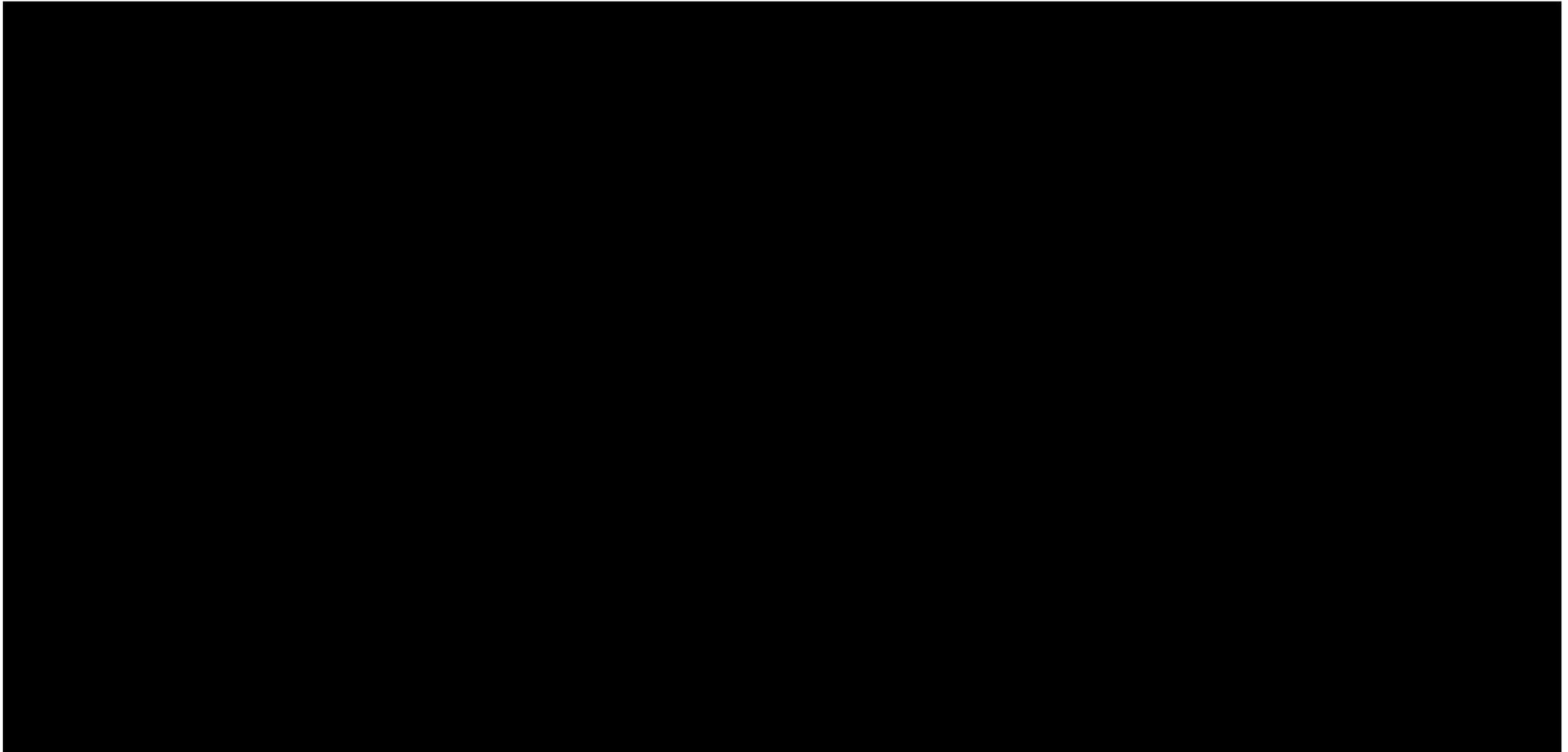
| Construction Phase   | Annual Cost (Real 2025) | Operational Phase          | Annual Cost (Real 2025) |
|--|-------------------------|----------------------------|-------------------------|
| Director (FTE)   | ██████████              | Director (FTE)             | ██████████              |
| Contracts Manager (FTE)  |                         | Contracts Manager (FTE)    |                         |
| Admin, Legal & Accountancy                                     |                         | Admin, Legal & Accountancy |                         |
| Consultant Advisors (incl. Employers' Agent, Owner's Engineer) | ██████████              | Non-Executive Director(s)  | ██████████              |
| Non-Executive Director(s)                                      | ██████████              |                            |                         |
| <b>Total (per annum)</b>                                       | ██████████              | <b>Total (per annum)</b>   | ██████████              |

The base scenario funding stack is shown in Figure 6—1 below, based on the project CapEx for the initial investment (i.e. not including the later equity investment in Year 18 to replace the gas boilers with electric boilers and associated grid upgrades). In this configuration, the project is sensitive to Connection Charge levels. Expressed as a proportion of total CapEx, the Connection

<sup>2</sup> The TEM outputs are produced in a Real, 2025 price base. This does not account for the impact of inflation but enables year to year comparison, based on "today's" terms. The Financial Model applies inflation as a macro-economic factor and reports outputs in a Nominal price base with values presented in absolute terms.

Charges account for [REDACTED] of the total, which is at the mid-high end of examples in the market, reflecting the complexities in Cambridge of conservation, planning and grid constraints and the counterfactuals.

The later investment required to cover the costs of the replacement of gas boilers with electric boilers and associated grid upgrades has been modelled to date as 100% equity. It is not possible to commit NWF to debt investment for an expenditure so far into the future, but it is likely that in delivery, any future investment would be delivered as a combination of equity and debt, subject to shareholder decisions at that time.



In developing an appropriate funding stack for each base scenario, it was agreed that a flexible debt product developed by the National Wealth Fund (NWF) should be included, as the Council is a potential majority investor and could enable the project to benefit from a concessional interest rate. In each base case scenario, the model uses the following key assumptions (developed through engagement with NWF representatives):

1. Debt-Equity Ratio of 70:30;
2. Loan term of 35 years;
3. [REDACTED]
4. A minimum debt service coverage ratio of 1.2, but which is optimised by scenario to 1.86 in the Financial Case;
5. Interest Rate to Council of 30-year Gilts + 40bps, in line with NWF guidance.

Within the funding stack, it is also assumed that Green Heat Network Fund (GHNF) grant is secured by the project in all base cases. The nature of low carbon heat network projects and wider project factors (cost of electricity) means that it is highly unlikely that market financial returns will be achievable without GHNF grant. Based on the experience of the project advisors and through engagement with TriplePoint, the GHNF grant assumption has been set at [REDACTED] pence per kWh of heat delivered over the first 15 years of the project life. This is within the gated metric cap of [REDACTED] pence per kWh and close to the average award value in Round 9 (2025).

The identified pool of anchor heat load customers is essential to the successful project delivery. Securing sufficient buy-in is a key project risk. This buy-in is proposed in the form of the upfront capital contributions from customers (Advanced Connection Charges). For this project, these would be payable ahead of receiving a connection, due to the unique project structure. Connection Charges are usually paid on receipt of a connection. In this case, the financial model assumes they are paid ahead of the connections being provided (after Final Investment Decision, but before heat on) to balance working capital.

### 6.3 Financial resources & budgets

The key variable in each of the base scenarios was the deployment of NWF flexible debt. The terms of this vary depending on the ownership structure employed. In instances where the Local Authority retains a majority shareholding, a concessional rate is available which is expressed as 30-year Gilts + 40bps. The Local Authority must comply with Subsidy Control regulations where it is on-lending to an SPV, applying an on-lending margin as necessary. Furthermore, the Council should also apply a risk premium to the debt in recognition of its perspective of the risks being taken. The Local Authority has been advised to seek separate, specialist advice as to the actual on-lending margin required to ensure compliance with Subsidy Control regulations.

For the purposes of developing model assumptions, Sharpe Pritchard shared guidance from the Subsidy Control Regulations 2022 and an on-lending margin of [REDACTED] has been applied to the NWF rate. The Local Authority is ultimately responsible for repaying the debt to NWF and therefore this arrangement carries some additional risk in the event the Heat Network Company (SPV) is unable to make debt repayments.

If the Local Authority does not hold a majority shareholding (>50%), NWF is prepared to lend to the project SPV at "Private Sector Rates," which are "typically" expressed as 30-Year Gilts + 250-350bps.

The specific base scenario configurations and outputs are summarised in Table 6—3 below.





Table 6—4 Summary of Pain/Gain Share Sensitivity Assumptions

| Metric                | Equal Share | Equity & Customers | Equity Only |
|-----------------------|-------------|--------------------|-------------|
| Equity Investor Share | 33.33%      | 50%                | 100%        |
| DBOM Contractor Share | 33.33%      | 0%                 | 0%          |
| Customer Share        | 33.33%      | 50%                | 0%          |
| <b>Total</b>          | <b>100%</b> | <b>100%</b>        | <b>100%</b> |

Table 6—5 Impact of Pain/Gain Sensitivities on Equity IRR

| Metric               | Financial Case | Equal Share | Equity & Customers | Equity Only |
|----------------------|----------------|-------------|--------------------|-------------|
| Equity IRR (40-year) | ████           | ████        | ████               | ████        |

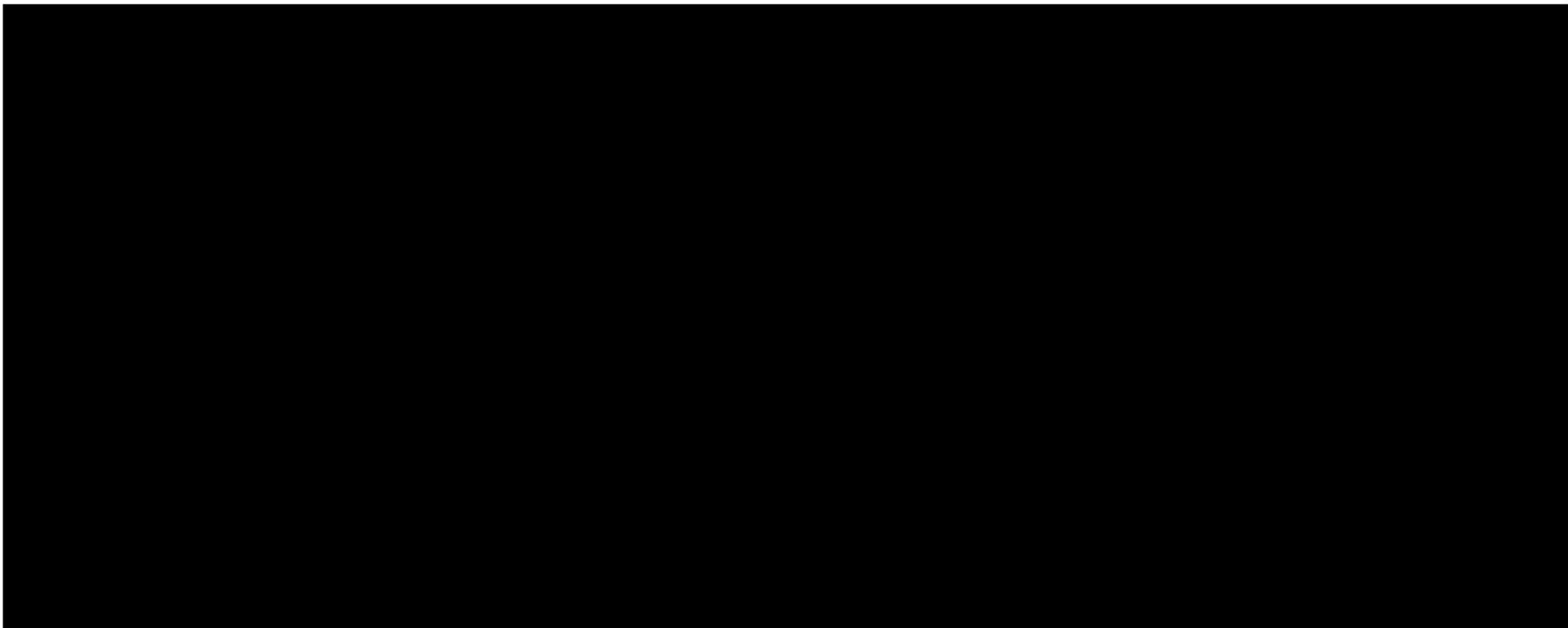


Figure 6—2 highlights the greater impact on the levelised heat price of the pain/gain share, if the overspend risk is shared with the customer. The impact of a maximal overspend, modelled at 30%, would potentially see an increase in Levelised Heat Price for customers in all cases, but the Equity IRR reduces significantly reflecting the shared risk. This risk sharing arrangement will be considered further in the Pre-Commercialisation Stage to refine the proposition.

## 6.5 Conclusions

The key findings from the financial modelling are as follows:

1. Project returns must reflect the risks taken by investors. The project revenues are the primary lever through which returns can be delivered. The Levelised Tariff has been increased through the financial modelling process to reflect the additional costs included (management team and financing) and to achieve the required investor returns.
2. The preferred option has been configured to meet the equity investors' target hurdle rate, taking account of project risk and delivering a 40-year Equity IRR of 12%.
3. Levelised Heat Price to customers remains below counterfactual equivalents as follows:

| Levelised Heat Price (Nominal)            | Counterfactual | Preferred Option | Variance   |
|---|----------------|------------------|------------|
| [REDACTED]                                | [REDACTED]     | [REDACTED]       | [REDACTED] |
| [REDACTED]                                | [REDACTED]     | [REDACTED]       | [REDACTED] |
| [REDACTED]                                | [REDACTED]     | [REDACTED]       | [REDACTED] |
| <b>Total Levelised Heat Price (p/kWh)</b> | [REDACTED]     | [REDACTED]       | [REDACTED] |

4. Connection Charges account for a significant proportion of the capital costs (62%) – this is comparable with many heat networks (typically over 50%). Connection Charges are paid by customers without an expected return and should be compared to the upfront costs of installing a counterfactual option. The extensive pool of customers with anchor heat loads is essential to the successful delivery of the project. Securing sufficient buy-in from individual Strategic Partners to progress the project is a key project risk. Following Letters of Support at this stage, this buy-in is ultimately proposed to be the form of the upfront capital contributions from customers (Advanced Connection Charges). In this case, the financial model assumes they are paid ahead of the connections being provided (after Final Investment Decision, but before heat on) to balance working capital. Connection Charges have been set in the model to offer a reduction against counterfactual costs in the base case.
5. The funding stack includes NWF debt on-lent by the council with a margin of 3.1% to ensure compliance with the Subsidy Control regulations, also reflecting the risk to the Council as they are ultimately responsible for repaying the NWF debt.
6. A Pain/Gain share is considered by the prospective investors to offer the best risk sharing arrangement in the event of a capital cost overspend. Should a DBOM contractor be prepared to enter into this arrangement, this would offer the best compromise solution and risk sharing. [REDACTED]. This risk sharing arrangement will be considered further in Pre-Commercialisation Stage to help refine the proposition, to ensure it works for both investors, customers and the developer



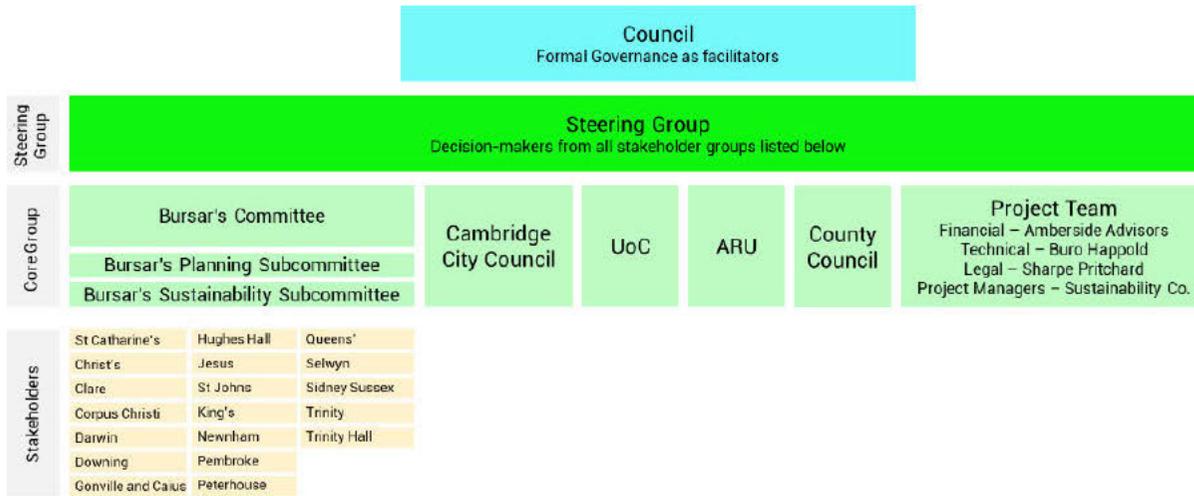


Figure 3 DPD Governance Structure

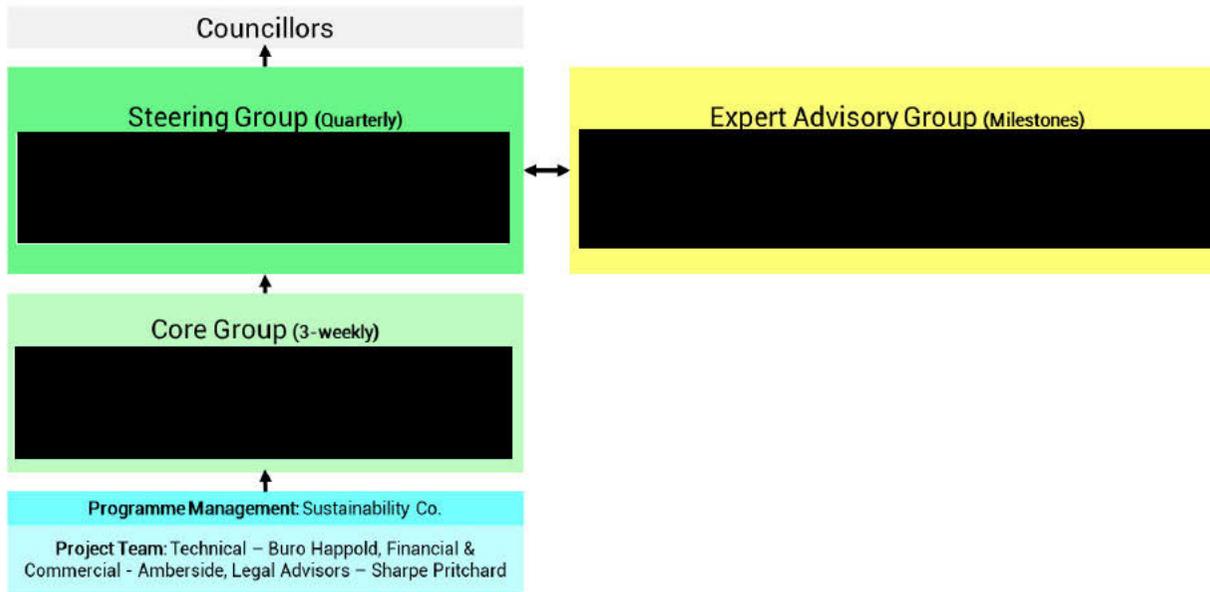


Figure 4 DPD Decision-Makers

**Table 7—1 DPD Governance Meetings**

|  | <b>Role</b>   | <b>Key Decisions</b>  | <b>Reporting</b>  |
|--|---|---|---|
| <b>Council</b><br>Milestone                  | Project enabler, facilitation, procurement, contractor management and funding.<br>Programme oversight and decision-making.                | March 2026 – Outline Business Case Approval<br>September 2025 – Feasibility study approval, and investment in Outline Business Case resourcing. | Formal Cabinet and Scrutiny papers.<br>Informal Member and Ward Councillor briefing at key milestones.  |
| <b>Steering Group</b><br>Quarterly           | Strategic decision-making and approvals<br>Formal feedback to heat network team   | See Appendix D for list of decisions taken.   | Quarterly report includes summary position on budget, risks and opportunities, programme, change log and benefits realisation.  |
| <b>Core Group</b><br>3-weekly                | Operational decision making<br>Informal feedback to heat network team on project development<br>Provide recommendations to Steering Group |   | 3-weekly report that includes budget, risks and programme update.   |
| <b>Stakeholder Consultation</b><br>Milestone | Informal feedback from stakeholders and statutory consultees, with the aim of derisking the Minimum Viable Product.                       | OBC formal review by Strategic Partners in Q1 and Q2 2026   | Minutes and Actions from five workshops informed development of the Outline Business Case:<br>Technical Shortlisting workshop<br>Technical Longlisting workshop<br>Shortlisting delivery models<br>Preferred Delivery Model workshop<br>Funding Option workshop<br><br>Formal response from Greater Cambridge Shared Planning Service to a series of three meetings with relevant statutory consultees via a Planning Performance Agreement (PPA) |

### 7.1.3 Updated Governance Arrangements until Final Investment Decision

As the project moves from DPD into Pre-Commercialisation and Commercialisation, governance arrangements have been reviewed to align with the Preferred Delivery Model of a customer owned energy company.

This 51:49 Joint Venture between Cambridge City Council and up to 8 Strategic Partners, needs to be ready to go live at Final Investment Decision (FID) in summer 2028. Ahead of this, all potential customers and equity investors need to be given the opportunity to influence further project development through derisking and optimisation.

Strategic Partners may subsequently choose to update their customer and/or equity investment positions. The new governance arrangements need to be flexible enough to accommodate any such changes. It is for this reason that the following governance updates are recommended for Pre-Commercialisation and Commercialisation Stages:

- 1) **Cambridge City Council continues as lead partner:** facilitates project development, including development of the Joint Venture customer owned energy company; procurement of DBOM contractor; and securing public-financing for the project. Regular meetings will also be arranged with Council finance and procurement officers.
- 2) **Steering Group is replaced by a Shareholder Committee**, which is open to all potential equity investors and customers. This becomes the new strategic decision-making body until the Joint Venture is established. Councillors provide political input into the reports before they go the Steering Group to ensure ongoing political buy-in.
- 3) **Core Group is maintained** for operational decision making until the Heat Company is established. The Core Group takes operational decisions, monitors progress and provides recommendations to the Steering Group and then its replacement Shareholder Committee.
- 4) **Expert Advisory Group** continues to provide due diligence during Pre-Commercialisation and Commercialisation.
- 5) **Updated Memorandum of Agreement (MoA)** for all Strategic Partners to sign in Q1 2026, setting out the basis for individual and collective involvement during Pre-Commercialisation and Commercialisation Stages. All stakeholders will continue in their role as potential customers, noting that some customers

have Expressed an Interest in becoming equity investors at the end of Commercialisation.

- 6) **Non-Disclosure Agreement (NDA)** for all Strategic Partners at the point at which the project moves into Commercialisation Stage.

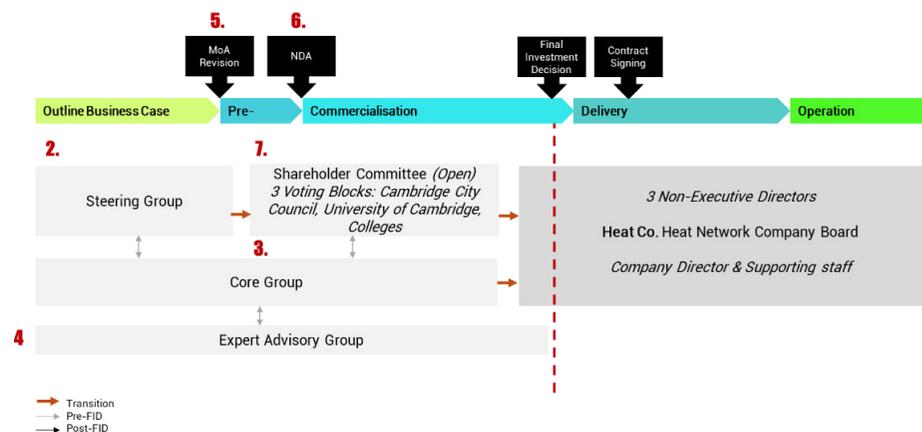


Figure 5 New Governance Arrangements until Final Investment Decision

- **Shareholder Committee:** provides overall strategic oversight and direction to the Project during Commercialisation Stage. Cambridge City Councillors provide political input into the reports before they go to Shareholder Committee, to ensure ongoing political buy-in.
- **Frequency of meetings:** Quarterly  
**Chair:** Cambridge City Council Senior Officer  
**Vice Chair:** University of Cambridge Senior Officer
- **Attendance:** The Committee is open to all potential equity investors and prospective heat network customers to promote transparency and fair participation. The Cambridgeshire County Council is invited to attend. Advisors/consultants may be invited to present updates and recommendations but will not have voting rights.

- **Voting Representatives:** To streamline decision-making, voting will be exercised through three voting blocks, with one voting representative each from (i) Cambridge City Council, (ii) the University of Cambridge, and (iii) the University Colleges.
- **Voting:** Decisions will be taken by simple majority of the voting representatives. Only the three voting representatives may vote. As lead partner, Cambridge City Council needs to support each decision.
- **Secretariat:** Minutes, actions and key decisions will be issued promptly after each meeting for review and agreement.
- **Transition to HeatCo:** The Shareholder Committee will stand down 6–12 months prior to Final Investment Decision, at which point governance will transfer to the HeatCo Board (replacing both the Shareholder Committee and Core Group). The respective roles of equity investors and customers will be set out in the HeatCo governance documentation at that time.

#### 7.1.4 Heat Company (HeatCo) Board

The Heat Company Board sets the strategic direction for its small Management Team and Employer’s Agent. It becomes operational six to twelve months before FID, at which point the Shareholder Committee is no longer needed.

The same Board is responsible for both the HeatCo operating company (the regulated entity) and the JV Holding Company (HoldCo).

**Resourcing:** for the first 5 years through to the end of Phase 1 MVP construction and ‘Heat On:’

- Council Programme Manager (already funded and HeatCo Board Member)
- 1 FTE Company Director - the sole Executive Director, with overall responsibility for the project and company. Produce the company’s Business Plan that’s reviewed annually by the Board; manages the Board meetings; engages Strategic Partners; and runs the company.
- 0.5 FTE Contract Manager to client the DBOM contract, supported by the Employer’s Agent.

- 0.5 FTE Stakeholder Engagement Manager.
- 1 FTE Project Manager
- Employer’s Agent consists of Owner’s Engineer, Contract Administrator, Cost Consultant, Principal Designer, Clerk of Works and Bank Monitor

The respective roles of equity investors and customers will be set out in the HeatCo governance documentation at that time.

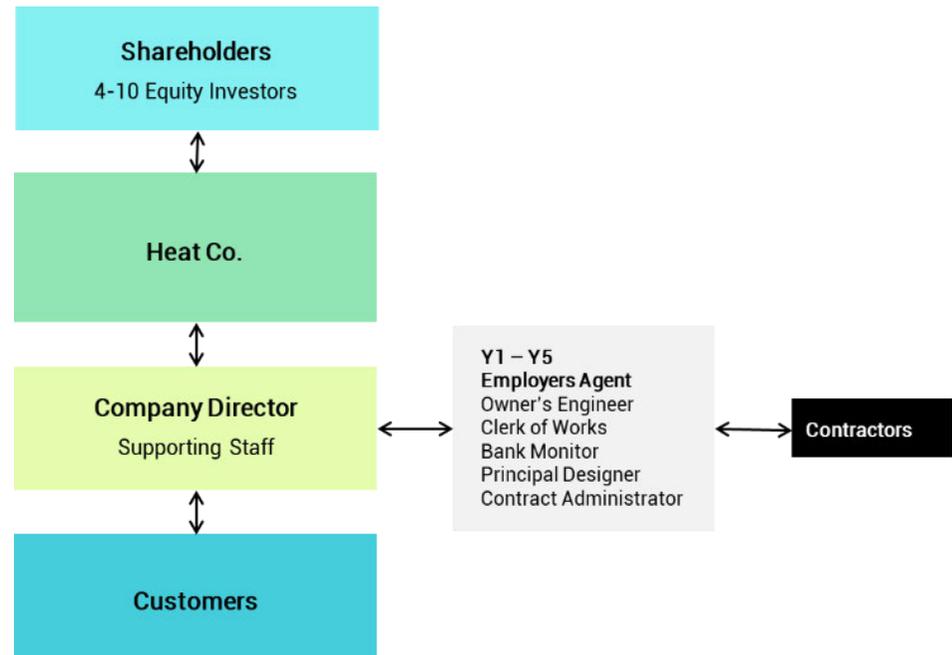


Figure 6 New Governance Arrangements from FID to Operations

## 7.2 Forward Programme

### 7.2.1 Workstreams

Table 7—2 summarises the key workstreams during Pre-Commercialisation, Commercialisation; Final Design and Construction; and Operations. Given the success achieved to date and to ensure project continuity on a tight timeline, it is recommended that the existing project team is retained for Pre-Commercialisation Stage.

**Table 7—2 Future Workstreams**

|   | Workstreams  | DPD  | Pre-Commercialisation  | Commercialisation   | Final Design & Construction  | Operations     |
|---|--|--|--|---|--|----------------|
|   | <b>Stage Gate</b>  | Completion March 2026  | Steering Group decision to proceed at risk, ahead of GHNF grant  | Shareholder Committee is formed<br>Decision to proceed is dependent on GHNF funding & equity investors  | Shareholder Committee decision on Financial Investment Decision, based on Final Business Case  | From 'Heat On' |
| 1 | Programme Management   | Outline Business Case<br>Update Memorandum of Agreement, template Letter of Support and Non-Disclosure Agreement   | Sustainability Co lead development and delivery of Workstreams 1 to 10<br><br>Regular programme, risk and budget reporting to Council lead, Core Group & Shareholder Committee.                                    | Sustainability Co lead development of Final Business Case (FBC) for Final Investment Decision (FID) by Cabinet, equity investors and MVP customers.<br><br>Regular programme, risk and budget reporting to Project Core Group & Shareholder Committee<br><br>Manage Owner's Engineer and Project Team | Programme management to service HeatCo   |                |
| 2 | Strategic Partner Governance & Quality Assurance<br><br><i>(Key decision/ approval points that depend on new evidence collation will be subject to appropriate scrutiny via the regular cycle of Core Group, Shareholder Committee and/or Expert Advisory Group)</i> | Finalise DPD with Governance approvals and feedback<br><br>Oversee and support individual governance approval processes x 20<br><br>Coordinate answers to related stakeholder OBC queries on OBC from 21 Strategic Partners. | Cambridge City Council governance (via Jaques van der Vyver, Ben Binns and Lynne Miles)<br><br>Continue Core Group<br><br>Continue Expert Advisory Group at key milestones.<br><br>Establish Shareholder Committee | Cambridge City Council governance (via Jaques van der Vyver, Ben Binns and Lynne Miles)<br><br>Continue Core Group until HeatCo is established<br><br>Continue Expert Advisory Group at key milestones.<br><br>Support Strategic Partner individual governance processes.                             | Cambridge City Council governance (FID decision by Cabinet + Scrutiny Committee)<br>HeatCo<br>Employer's Agent with Owner's Engineer, Contract Administrator, Cost Consultant, Principal Designer, Clerk of Works and Bank Monitor |                |

|   | Workstreams                             | DPD  | Pre-Commercialisation   | Commercialisation   | Final Design & Construction   | Operations          |
|---|---|--|---|---|---|---------------------|
|   |   | University of Cambridge governance approvals<br>Lead collective governance arrangements – Core Group, Steering Group and subsequent Shareholder Committee  | Sustainability Co update OBC baseline and content to reflect formal Strategic Partner feedback ahead of GHN application.<br><br>Technoeconomic modelling update provided by Buro Happold.<br><br>Financial modelling update provided by Amberside.    | Shareholder Committee and Core Group transition into HeatCo 6 months before FID. Appointed by individual equity investor groups using Skills Matrix for strategic coordination. In parallel,<br><br>Ensure Policy alignment e.g. national regulation, Heat Zoning, Local Plan and Council's Climate Change Strategy                 |   |                     |
| 3 | Stakeholder engagement & Communications | Early informal and formal engagement with Statutory Consultees<br><br>Early engagement with energy centre neighbours<br><br>Ongoing engagement with interdependent projects, including new heat networks & new developments<br><br>Quarterly newsletter – targeting general stakeholder audience | Stakeholder updates<br>Local residents<br>Political engagement<br>Local Stakeholder Groups<br>Strategic Partners<br>Public Relations<br>Strategy/project positioning<br><br>Quarterly newsletter  | Sustainability Co & appointed contractors undertake local energy centre engagement<br><br>Customer engagement<br><br>Statutory consultee engagement, including Environment Agency and Cam Conservators<br><br>Quarterly newsletter<br><br>Press release following Final Investment Decision<br>Construction Communications Strategy | Undertake stakeholder engagement to support planning application<br><br>Customer engagement | Customer engagement |
| 4 | Technical derisking & betterment        | Targeted heat meter installations to improve accuracy of heat demand data.<br><br>Update Future Proofing Guidance Note   | Buro Happold undertake:<br>Budget application with UKPN<br>Thermal store RIBA Stage 2 design for Downing College and ARU.<br>Longlist potential roundabout thermal store options.<br>Riverside Energy Centre RIBA Stage 2 design as betterment to MVP | Planning Application strategy: potential assessments, statutory consultee engagement and planning application preparation<br><br>Engineers undertake technical derisking:<br>EIA Screening Assessments<br>GPRS surveys and/or trial pits at high-risk sections of pipe route e.g. Trinity Lane. We're                               | Work package tbc  | Work package tbc    |

|   | Workstreams                          | DPD                 | Pre-Commercialisation   | Commercialisation   | Final Design & Construction  | Operations |
|---|--------------------------------------|---------------------|---|---|--|------------|
|   |                                      |                     | Structural survey for BT Exchange<br>River survey<br>Technical scoping of procurement   | going deeper than most existing utilities.<br>Community energy centre codesign/ engagement<br>Civil design of river offtake   |  |            |
| 5 | Planning and architectural derisking |                     | Sustainability Co consider the following requirements:<br>Transport consultancy<br>Aboricultural consultancy<br>Planning consultancy  | Shareholder Committee decision – whether to undertake RIBA Stage 3 design client-side during Commercialisation, or by DBOM contractor once appointed. There may be value in focusing RIBA 3 on specific pipe sections, energy centres and College connection points to proportionally de-risk. Include within this RIBA 2 and 3 architectural designs for Energy Centres and thermal store.<br><br>RIBA Stage 2-3 design – architectural<br><br>1 x PPA meeting | RIBA Stage 4-7 design undertaken by DBOM contractor after FID.           |            |
| 6 | Procurement                          | Soft market testing | Sustainability Co reprocure heat network team, with option for engineers to remain as Owner's Engineer<br><br>Amberside and Sustainability Co develop Procurement Strategy for Shareholder Committee approval. If early contractor engagement is chosen, more work can be undertaken by the delivery partner.<br><br>Amberside undertake additional soft market testing for DBOM procurement. | Commercial advisors procure DBOM contractor (potentially including Framework for secondary design, logistic modelling & Planning Agent to develop Planning Strategy and manage the planning application, including a Quality Design Review to help derisk the project.<br><br>DBOM procurement includes competition preparation, evaluation prep, PIN, ITT, ISFT, evaluation, notifications and standstill periods  | Contract Manager clients DBOM contractor, supported by Employer's Agent. | N/A        |

|   | Workstreams                       | DPD  | Pre-Commercialisation  | Commercialisation   | Final Design & Construction  | Operations       |
|---|-----------------------------------|--|--|---|--|------------------|
|   |                                   |  | <p>Amberside prepare tender pack with support of Sustainability Co (coordination and governance), Buro Happold (technical scope) &amp; Sharpe Pritchard (legal advice); scope of works, tender documents, KPIs &amp; schedules for Commercialisation Stage. Contractor resident liaison is built into construction contract.</p> <p>Sustainability Co and Amberside procure Owner's Engineer</p>   | <p>Sustainability Co procure PR company to help mitigate the risk of significant disruption.</p> <p>Sustainability Co and commercial advisors procure remainder of Employer's Agent (Contract Administrator, Cost Consultant, Principal Designer, Clerk of Works and Bank Monitor)</p> <p>Strategic Partners procure Company Director and company executives.</p>   |  |                  |
| 7 | Commercial derisking & betterment | <p>Prepare &amp; submit NWF and GHNF bids, including £1m Commercialisation grant</p> <p>Amberside undertake commercial derisking and further Sensitivity Analysis on back of formal Strategic Partner feedback, resetting the baseline to match.</p> | <p>Sustainability Co, Buro Happold and Amberside review government's Heat Zoning Consultation Response, with recommended action(s)</p> <p>Amberside define the principles and cost of Contributions in Kind, with a focus on the energy centres and thermal stores</p> <p>Sustainability Co and Buro Happold review the Local Plan Net Zero building review</p> <p>Sustainability Co and Amberside undertake a Benefits in Kind review</p> | <p>Commercial advisors develop Heat Supply Agreements for customers</p> <p>Commercial advisors establish commercial principles and Heads of Terms for 4 x energy centres and thermal stores.</p> <p>Commercial advisors ensure regulatory compliance, noting that this is a technically and commercially complex area, which is constantly evolving.</p> <p>Commercial advisors to develop financial model e.g. moving it from annual to monthly cashflows.</p> | Work package tbc   | Work package tbc |
| 8 | Financial Management              | -  | -  | Sustainability Co produce GHNF grant and NWF loan reports.  | <p>Manage GHNF grant and NWF loan</p> <p>Manage local energy company's Profit &amp; Loss account</p> |                  |
| 9 | Joint Venture set-up              | -  | Sustainability Co develops partnership principles & associated governance arrangements   | Sustainability Co leads work with Commercial Advisors and Legal Advisors to set up HeatCo. so that it's mobilised ready for FID.  | Company evolves. Other equity investors and Non-Executive Directors join Joint                       | -                |

|    | Workstreams                                   | DPD | Pre-Commercialisation  | Commercialisation   | Final Design & Construction  | Operations          |
|----|---|-----|--|---|--|---------------------|
|    |   |     | Amberside develop JV principles. Sharpe Pritchard to draft.        | Initially set it up as a wholly owned Council subsidiary, with all IPR vested within the SPV.<br><br>Actions include HeatCo company registration to set up shell company; Joint Venture Agreement; Shareholder's Agreement, Articles of Association and Delegations Matrix; recruitment strategy; regulatory compliance; Communications Strategy; develop company policies and processes by adapting Council policies and processes; and company branding so it's future proofed for expansion. | Venture at Final Investment Decision (recruited by shareholders).<br><br>Potential Feasibility Study for heat network expansion. |                     |
| 10 | Heat Network Digital Twin (externally funded) | -   | Sustainability Co prepare and submit Proof of Concept funding bid. | Subject to successful funding bid, develop procurement scope for Heat Network Digital Twin.   | Procurement  | Contract management |

### Assumptions

1. Technical derisking is mainly undertaken at Commercialisation Stage, once it is confirmed who's taking the delivery risk via OBC formal approval.
2. Commercial derisking is needed during Pre-Commercialisation Stage, to obtain a first assessment of commercial costs associated with all the energy centre locations and thermal stores.
3. Cambridge City Council facilitates procurement of the DBOM contractor, including the option for collective purchasing of energy consultancy services for secondary network designs.
4. Final Investment Decision takes place after tender award.

## 7.2.2 Timeline

Figure 7 provides the summary Heat Network Programme from Outline Business Case to Financial Investment Decision, which is scheduled for summer 2028. Interdependencies are highlighted and listed in Table 7—3 Heat Network Interdependencies below.

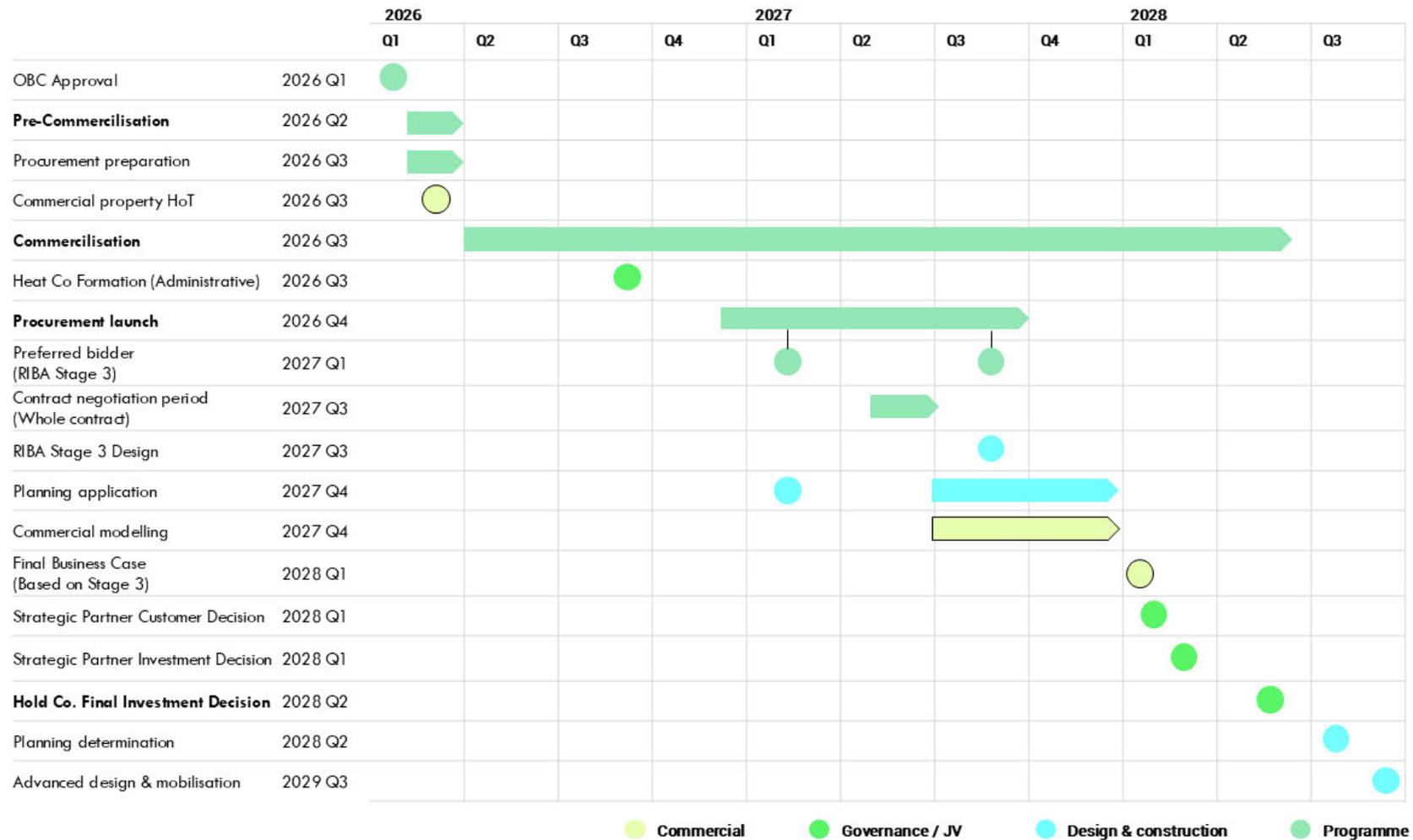


Figure 7 Pre-Commercialisation to Financial Investment Decision Programme

### 7.3 Heat Network Phasing

The heat network build-out is proposed in two Phases: Phase 1 2030-32, and Phase 2 2035. These phases have been derived from individual Strategic Partner development and decarbonisation plans, to allow synchronisation with existing gas boiler replacements. This proposed phasing programme is subject to change through further programme development.

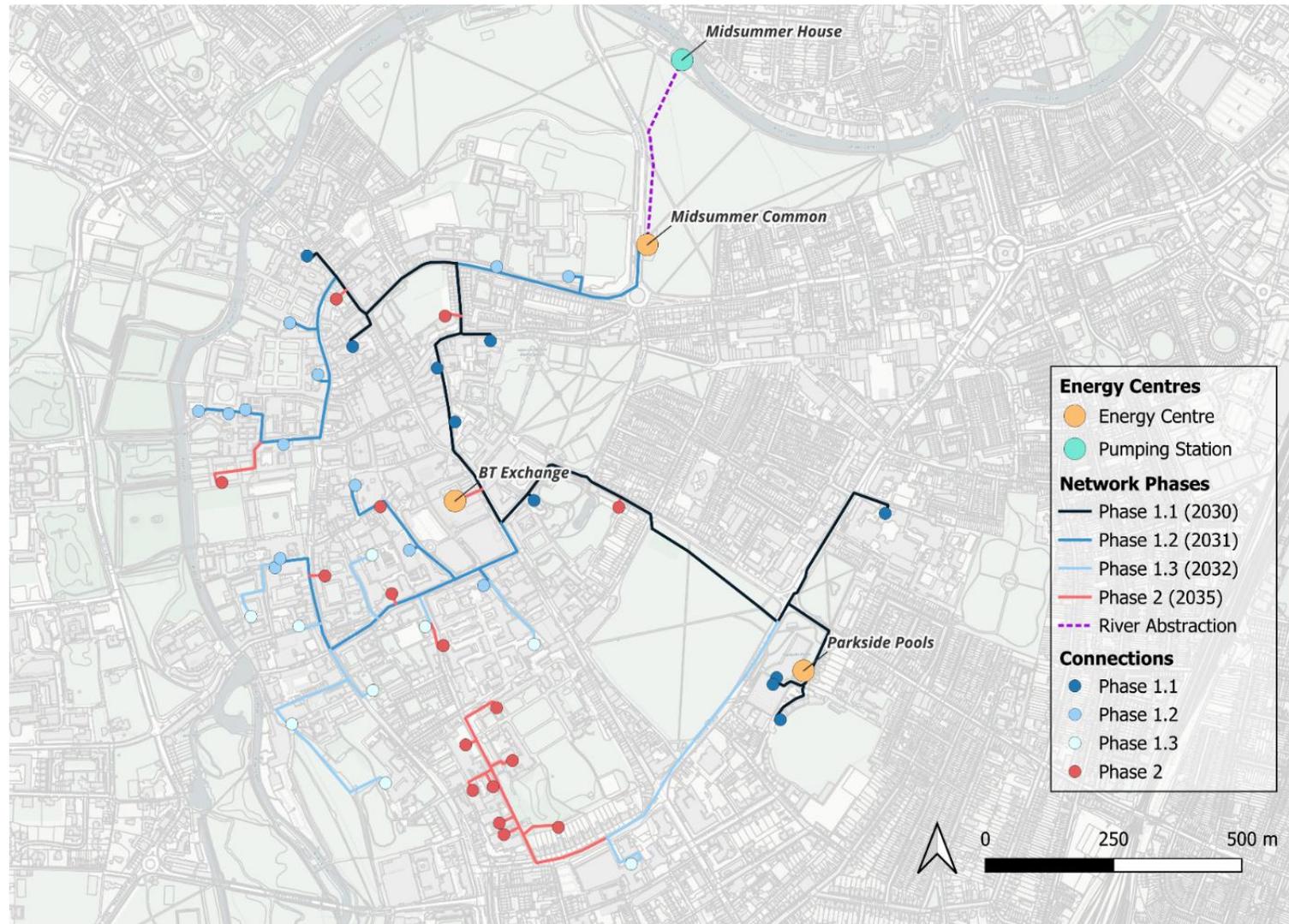


Figure 7—8 Heat Network Phasing

## 7.4 Heat Network Interdependencies

Initial stakeholder engagement has exposed several interdependent programmes happening in parallel to the City Heat Network development timeline. Ongoing engagement will monitor the development of these programmes and seek to manage emerging risks and opportunities. This engagement takes place through regular meeting series and participation in strategic County-wide meetings hosted by Cambridgeshire Highways (HAUC meetings).

Some of the interdependencies identified are strategic in nature, including Local Government reorganisation and Heat Network Zoning. Others have direct and indirect spatial impacts, such as the Local Plan consultation, University of Cambridge Reshaping Our Estate, and UKPN Grid Reinforcements. There are also several development projects being undertaken by individual colleges and stakeholders, which may present extra constraints or opportunities to heat network delivery.

**Table 7—3 Heat Network Interdependencies**

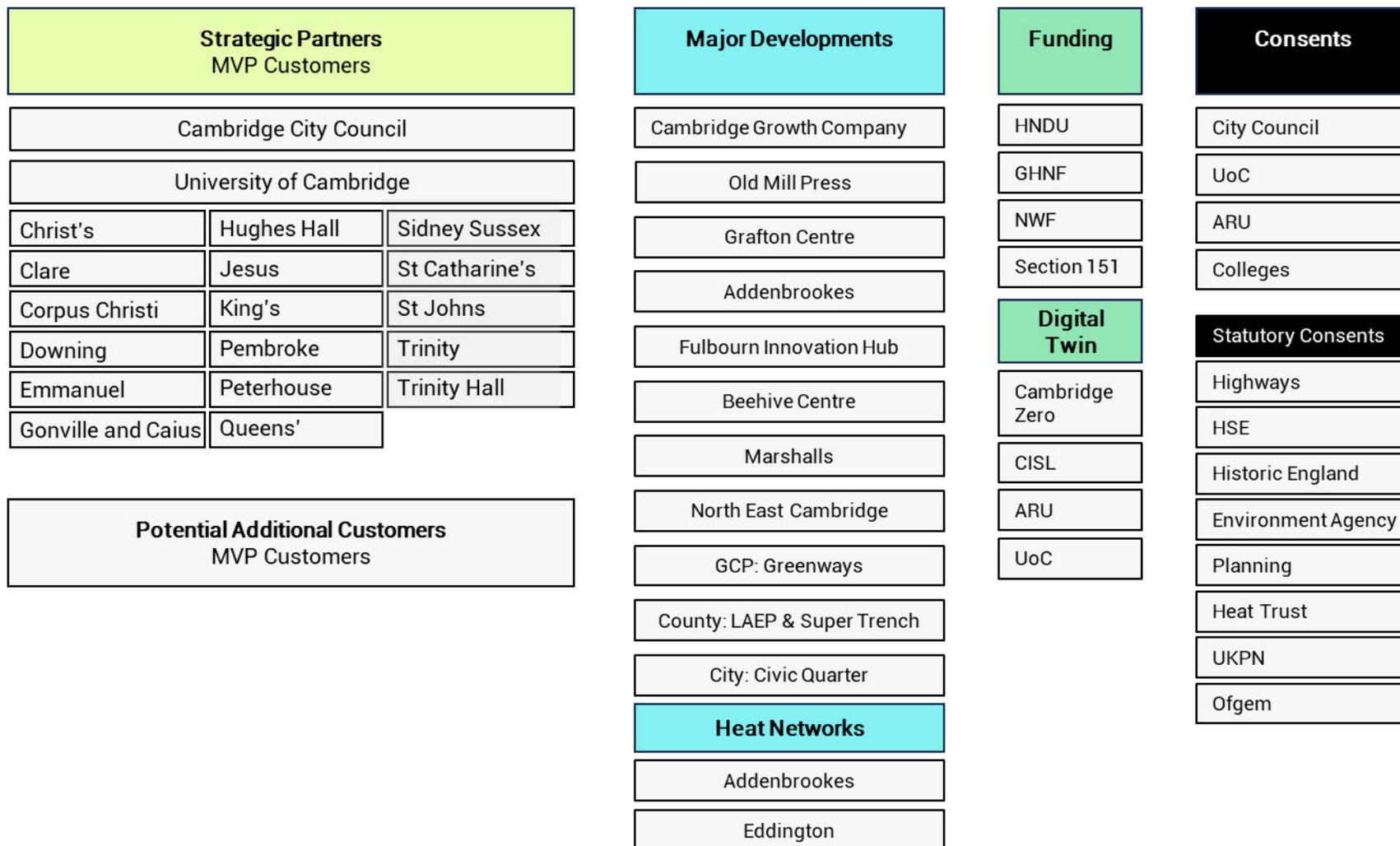
| No. | Interdependency                                     | Timeframe        | Owner                   | Risks  | Benefits  |
|-----|---|------------------|-------------------------|--|---|
| 1   | Local government reorganisation                     | Now – April 2028 | Local Gov               | Political risk that the project could be stalled by uncertainty created through governance transition period   | Potential that City and County services fall under a single local authority   |
| 2   | Cambridge City Council: Civic Quarter Redevelopment | 2026 - 2028      | Cambridge City Council  | May require phasing of some highways elements to prevent re-delivery. There is no conflict according to current delivery programme.                                      | Large-scale development going before heat network construction<br>Opportunity for co-delivery of works  |
| 3   | University of Cambridge: Reshaping our Estate       | 2024 - 2044      | University of Cambridge | Heat network connections are delayed or deemed inappropriate   | Optimum timing for the University to consider heat network development, as it in parallel reshapes its Estate. Connection opportunities can be refined.   |
| 4   | Energy retrofit of Strategic Partner buildings      | Ongoing          | Strategic Partners      | Capital constrained budgets and historic nature of buildings, make energy efficiency improvements too expensive to do quickly and at scale.                              | High temperature heat network solution enables the maximum number of connections, with many buildings able to connect.<br>Possible co-delivery of projects, to prevent further disruption in city centre  |
| 5   | Heat Network Zoning                                 | Ongoing          | Cambridge City Council  | Mandating connection of large heat loads becomes contentious and leads to stakeholder push back & appeals using 'exemptions'   | Mandating heat network connections is a game changer for heat network expansion, significantly derisking the Cambridge City Centre Heat Network project. Nonetheless, we're still focussing on the benefits and added value, to incentivise connection regardless of legislation.   |
| 6   | Local Plan Consultation                             | 2026 - 2027      | Cambridge City Council  | None   | Heat network development has been included in the new Local Plan, offering an early consultation opportunity ahead of any specific heat network development.  |
| 7   | UKPN Grid Reinforcements                            | Ongoing          | UKPN via project team   | If it's not coordinated at a strategic level, electrical grid reinforcements could become prohibitively expensive to on-site and heat network decarbonisation solutions. | The new Local Area Energy Plan (LAEP) for Cambridgeshire enables co-ordination of long-term electrical grid development for Cambridge and its heat network project. In addition, the heat network team's UKPN Budget Application minimises the risk and maximises strategic alignment. Long lead in periods are common for both power grid upgrades and heat network infrastructure delivery. |

| No. | Interdependency                    | Timeframe | Owner                                  | Risks   | Benefits  |
|-----|------------------------------------|-----------|--|---|---|
| 8   | Greenways Development (Hills Road) | 2027-2027 | GCP                                    | Hills Road is a major arterial to the City Centre. It does not feature in the heat network route. However, co-ordination will be required to prevent compounded traffic disruption.   | Optimise timing and co-ordination with stakeholders.  |
| 9   | Business As Usual activity         | Ongoing   | All stakeholders                       | Many of the colleges and universities have a range of business functions, throughout the year. Planning access and installation of the heat network will need to minimise disruption and require coordination with individual stakeholders. | Optimise timing and co-ordination with stakeholders.  |
| 10  | Major Developments                 | Ongoing   | Colleges, Grafton Centre, Addenbrookes | Potential programme impacts, if works affect access or connection points.   | Potential to co-deliver aspects of the heat network may be possible depending on project programming. |

## 7.5 Stakeholder Management and Communications

### 7.5.1 Current Stakeholder Engagement – Outline Business Case

The Outline Business Case has required engagement stakeholders to secure project support, identify adjacent programmes, and provide information for the design development. The following stakeholders have been identified at this stage:



## 7.5.2 Proposed Stakeholder Engagement - Commercialisation

Engagement with stakeholders will continue through commercialisation, the stakeholder engagement goals are:

|   | Goal  | Lead               | Audience  | Engagement methods  |
|---|---|--------------------|---|---|
| 1 | Secure governance support and approval for the project                        | City Council       | Political<br>Strategic Partners   | Councillor Briefings, Newsletter<br>Newsletter                                    |
| 2 | Build industry relationships and project profile                              | Sustainability Co. | Industry  | Industry articles, Newsletter, Tender<br>Contractor engagement day                |
| 3 | Gain wider 'City' support for project, identify further development potential | Sustainability Co. | City Climate Leaders<br>Local Councillors<br>Public   | Newsletter, event attendance<br>Newsletter<br>Press, magazine, project exhibition |
| 4 | Manage customer inputs, agree terms, conditions and contracts                 | Sustainability Co. | Customers, Strategic Partners   | Workshops   |
| 5 | Manage investor inputs, agree investor terms, conditions and contracts        | Sustainability Co. | Equity investors, Strategic Partners  | Workshops   |
| 6 | De-risk energy centre and heat network development                            | Sustainability Co. | Local community<br>Planners<br>Statutory Consultees   | Workshops, 1:1s, exhibition<br>PPA meeting<br>PPA meeting / informal engagement   |
| 7 | De-risk financial and technical development of project                        | Sustainability Co. | Project funders<br>Expert Advisory Group  | Regular 1:1 Meetings  |
| 8 | Identify and manage interdependencies / opportunities                         | Sustainability Co. | Cambridgeshire County Council<br>Cambridge City Council<br>Greater Cambridge Partnership<br>Cambridge Growth Company<br>New developments<br>Eddington Heat Network<br>Addenbrookes Heat Network | Regular 1:1 Meetings  |

### 7.5.3 Key Communications Timeline

The timeline below indicates key communication periods from Pre-Commercialisation to FID. The project team will work with specialists to develop strong key messaging to clearly position the project, including the resultant challenges and benefits.

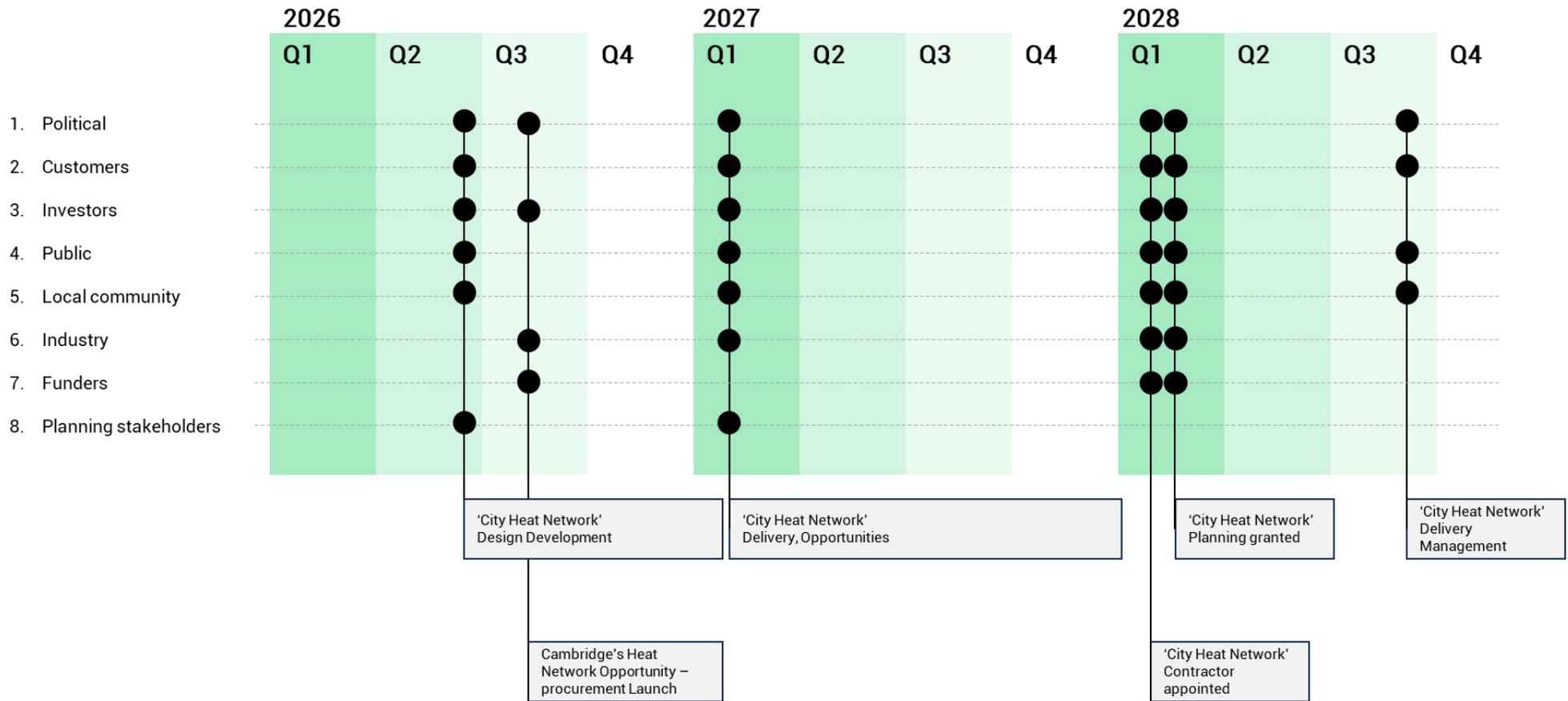


Figure 9 Key Communications Timeline - Commercialisation

## 7.6 Resourcing

### 7.6.1 Project organisation & resources – team members, roles & capability

The existing client-side heat network team is highly experienced in heat network project development, with over 100 years collective experience. Given the success achieved to date and to ensure project continuity on a tight timeline, it is recommended that the existing project team is retained for Pre-Commercialisation Stage. The furthest column in Table 7—4 provides a recommended Procurement Strategy for the heat network team.

**Table 7—4 Proposed Commercialisation Project Team**

| Who  | Company                | Role   | Procurement for Pre-Commercialisation<br><i>(subject to Steering Group agreement to proceed at risk with associated budget requirement)</i>                   |
|--|------------------------|--|---|
| Ben Binns<br>Jaques van der Vyver                | Cambridge City Council | Project Sponsor and Client-lead  | Existing Council employees. No procurement required.  |
| Jeff Laidler<br>Janet Hall                       | Sustainability Co      | Heat Network Programme Managers<br>Programme management<br>Strategic Partner and stakeholder engagement<br>Expert Advisory Group<br>Statutory consultations, including PPA<br>Strategic and Management Cases | Existing long-term contract for up to 10 years, with option for contract variation at each Stage Gate, including Pre-Commercialisation and Commercialisation. |
| Alasdair Young<br>Bill Wilson<br>Matthew Whiting | Buro Happold           | Technical engineers<br>RIBA Stage 2 design<br>Technoeconomic model<br>Heat Zoning Study<br>Economic Case   | Contract variation (tbc)  |
| Mark Easter<br>James Derbyshire                  | Amberside Advisors     | Commercial and financial advisors<br>Financial model<br>Financial and Commercial Cases   | Contract variation (tbc)  |
| Steve Gummer                                     | Sharpe Pritchard       | Project's legal advisors   | Framework (tbc)   |

## 7.6.2 Resourcing Budget

The resourcing budget is split across two project phases of Pre-Commercialisation and Commercialisation.

### Pre-Commercialisation

A forecast of **up to £0.6 million** of additional funding is required to deliver the Pre-Commercialisation Stage between March and October 2026, supported by DPD underspend project roll forwards from the City Council and many Strategic Partners. Cambridge City Council has in principle committed to cover this budget gap, with DPD underspend rolled forward to make up the remainder. The Council has made this 'Bridge Funding' proposal on the basis that it does so at risk, with full financial return at Final Investment Decision.

**Table 5 Pre-Commercialisation Resource and Budget Estimates: April to October 2026**

|   | Workstreams   | Forecast Resource                            | Forecast Budget                        |
|---|---|--|--|
| 1 | Programme Management  | Sustainability Co:                           | ██████                                 |
|   |   | ○ 0.6 FTE                                    |  |
| 2 | Strategic Partner Governance & Quality Assurance  | Programme Manager                            |  |
|   |   | ○ 0.6 FTE Senior                             |  |
| 3 | Stakeholder Engagement & Communications   | Project Manager                              |  |
|   |   | ○ 0.5 FTE Project                            |  |
| 4 | Joint Venture principles  | Manager                                      |  |
| 5 | Technical derisking & betterment  | Buro Happold                                 | ██████                                 |
| 6 | Pre-Commercialisation Procurement, including Procurement Strategy and tender pack preparation | Amberside                                    | ██████                                 |
|   |   | Sharpe Pritchard                             | ██████                                 |
| 7 | Commercial derisking & betterment   |  |  |
| 8 | Heat Network Digital Twin   | Excluded from existing budget considerations | Funded by Proof-of-Concept bid (tbc)   |
|   |   |  | <b>Total Forecast Budget £525-625k</b> |

**Table 6 Commercialisation Resource and Budget Estimates: November 2026 to June 2028**

|   | Workstreams                                      | Forecast Resource  | Forecast Budget   |
|---|--|--|---|
| 1 | Programme Management                             | Tbc once the scope is better defined through Pre-Commercialisation activity, accounting for the need to both | Tbc once the scope is confirmed, noting that it's highly likely to be >£1m, so will require additional gap funding, even with a successful GHNF bid with £1m Commercialisation grant funding. |
| 2 | Strategic Partner Governance & Quality Assurance |  |   |
| 3 | Set-up Joint Venture delivery vehicle            |  |   |
| 4 | Wider stakeholder engagement & Communications    |  |   |
| 5 | Technical derisking & betterment                 |  |   |
| 6 | Commercialisation Procurement                    |  |   |
| 7 | Commercial derisking & betterment                |  |   |
| 8 | Heat Network Digital Twin                        | Excluded from Commercialisation budget considerations  | Externally funded (tbc)   |
|   |  |  | <b>Total Forecast Budget £tbc</b>   |

#### Assumptions:

- A decision is needed whether to proceed with RIBA Stage 3 and/or planning as part of DBOM contract or client side. This has a big impact on the Commercialisation costs. Currently assumed no Stage 3 design.
- Strategic Partners proceed with the Preferred Option of a Joint Venture.
- Planning application/architectural designs are prepared during Commercialisation
- Commercialisation is 18 months and no longer
- Minimum of 1 College, University of Cambridge and City Council invest, with a maximum of 9 investors. The cost then depends on the number of additional Colleges and the associated due diligence, which the heat network team support.
- Forecast project legal costs have been included. To avoid Conflicts of Interest, individual Strategic Partners need to cover their own legal costs.

## 7.7 Customers

### 7.7.1 Heat Network Customers

CCCHN's Minimum Viable Product is centred on provision of heat to [REDACTED] Strategic Partners as initial anchor customers. Opportunities to extend to a wider customer base will be reviewed if heat capacity is available at latter stages of the project. Potential future customers were engaged at feasibility stage and kept informed by a regular project newsletter. [REDACTED] [REDACTED]. At DPD an equal funding contribution and voting representation of 33% was agreed. This formation has been updated for Pre-Commercialisation.

|              |              |            |
|--------------|--------------|------------|
| ■ [REDACTED] | ■ [REDACTED] | [REDACTED] |
| ■ [REDACTED] | ■ [REDACTED] | [REDACTED] |
| ■ [REDACTED] | [REDACTED]   | [REDACTED] |
| ■ [REDACTED] | [REDACTED]   | [REDACTED] |
| ■ [REDACTED] | [REDACTED]   | [REDACTED] |
| ■ [REDACTED] | [REDACTED]   | [REDACTED] |
| ■ [REDACTED] | [REDACTED]   | [REDACTED] |

### 7.7.2 Customer Impacts

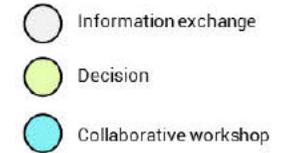
A list of ten reasons to connect to the heat network, the customer benefits are listed in the Strategic Case, Table 3—10. Previous workshops with customers have highlighted key impacts that customers wish to manage throughout the development process, these include:

- **Connection costs**
- **Heat tariffs, annualised costs**
- **Connection phasing and location**
- **Disruption to 'Business as Usual' activities**
- **Reputational damage if delivery is not smooth as planned**

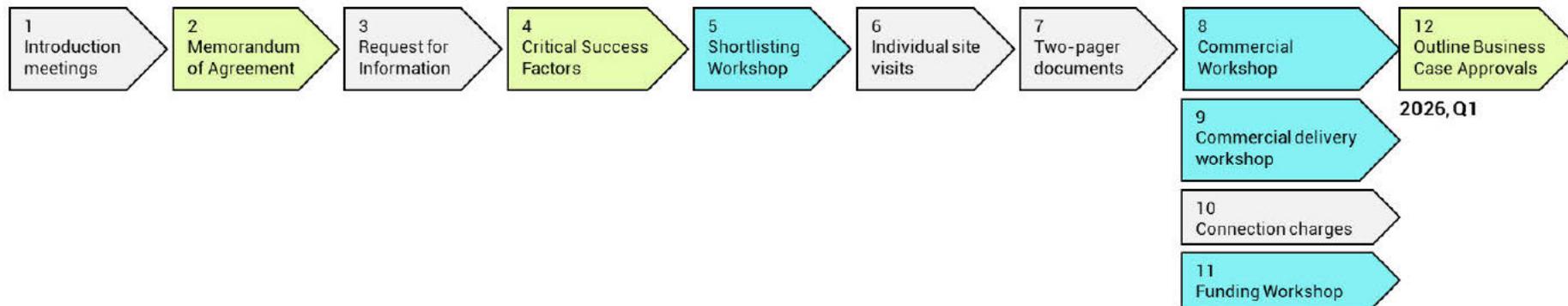
The management structure proposed in the OBC will maximise the potential of customers and investors to influence control in all these aspects. A combination of workshops, individual meetings, and information supplied to support key decisions is mapped out in the next section.

## 7.8 Customer Journey

CCCHN customers have been extensively engaged in the heat network development process. They have influenced all major decisions from provision of sites for the energy centre location, to the commercial, delivery and funding models proposed. This level of engagement will continue into Pre-Commercialisation and Commercialisation. To date, the level of information supplied to customers has been greater than what's typically level issued at this stage. Strategic Partners are aware that information is likely to change and require review at decision points.

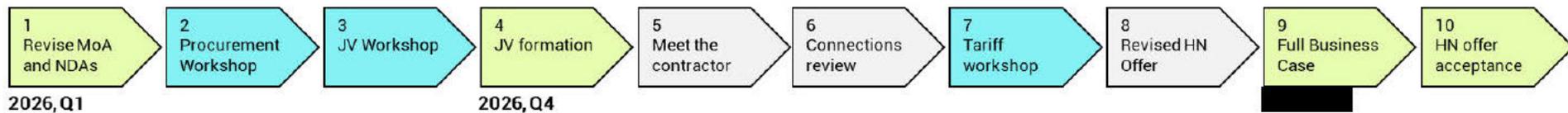


### Detailed Project Development



### Pre-Commercialisation (Apr – Oct 2026)

### Commercialisation



## 7.9 Customer Barriers

The main customer barriers that may inhibit connection to the heat network are:

| Barrier  | Mitigation   |
|--|--|
| <b>Governance processes:</b> extensive due diligence   | Future project governance is to be agreed at Outline Business Case, including ongoing representation of the three main customer groups: Universities, Colleges, and Council.   |
| <b>Project timing,</b> interdependencies of other major projects and funding requirements underway by Strategic Partners   | A first review for phasing of heat network connections has been undertaken with Customers. Customers are requested to inform the heat network project team of any changes to their proposed phasing.   |
| <b>Ability to deliver a secondary heat network:</b> in time, and to specification for heat network connection  | The heat network project will provide support to customers for the procurement of expertise to design and install secondary heat networks. This will take the form of a framework, through which services may be accessed.   |
| <b>Cost competitiveness:</b> current counterfactual comparisons show that some Strategic Partners will benefit from the heat network more so than others, due to alternative renewable heating system availability | Whilst customers have requested cost competitive heating, they also highlight the need for specialist experts present within the heat network company, to provide assure decision-making. The final commercial and economic models will be refined through Commercialisation and must hold these different aspects in balance.   |
| <b>Heating resilience, guarantees, and control</b>   | Customers are accustomed to being in full control of their heating system, with business activities, which can't tolerate heating outages or bad services. At DPD a note on the full resilience measures offered by a heat network were shared. These include; regulation requirements for attending heating issues and outages, physical heat network design, and back-up systems. The full resilience note is available in Appendix R. |

## 7.10 Assurance & Approvals

### 7.10.1 Detailed Project Development Approvals

During DPD, project assurance was successfully obtained from the Expert Advisory Group (EAG); Strategic Engagement with statutory consultees; and a strategic relationship with the National Wealth Fund. This is described in the Strategic Case. In addition, there were 3-weekly Project Sponsor meetings, 3-weekly Core Group meetings and Steering Group meetings at key project milestones. An overview of the key decision and assurance meetings is listed below, further details can be found in the Strategic Case, Appendices D and E.

**Table 7—7 DPD Approvals Roles**

| Group                                     | Role            | Overview  | Meetings  |
|---|-----------------|---|---|
| Steering Group                            | Decision-making | Strategy, programme, budget and key decisions       | Quarterly   |
| Expert Advisory Group                     | Assurance       | Technical and commercial due diligence              | During DPD  |
| Special Interest Group                    | Assurance       | Approach to retrofit, conservation & power upgrades | 24 September 2024   |
| National Wealth Fund                      | Assurance       | Financial due diligence                             | Commercial Delivery workshop<br>City Council internal workshops |
| Greater Cambridge Shared Planning Service | Assurance       | Planning Performance Agreement                      | Planning Performance Agreement                                  |
| UKPN                                      | Assurance       | Planning major electrical requirements              | Initial budget application                                      |

Quality assurance has been designed to be appropriate to the scope, scale and complexity of Pre-Commercialisation and Commercialisation.

### 7.10.2 Commercialisation Approvals Required

**Table 7—8 Commercialisation Approvals Required**

| Date      | Key Decision   | Decision Maker                         |
|-----------|--|--|
| 2026 Q3   | Pre-commercialisation completion   | Shareholder Committee                  |
| 2026 Q3   | Procurement strategy   | Shareholder Committee                  |
| 2026 Q2   | JV draft terms   | Shareholder Committee                  |
| 2026 Q3   | HeatCo formation   | Shareholder Committee                  |
| 2026 Q4   | Digital twin feasibility study & next steps  | Shareholder Committee                  |
| 2026 Q4   | Budget Review 1 – JV   | Shareholder Committee                  |
| 2026 Q4   | Procurement scope, including RIBA stages, architectural scope and betterment options | Shareholder Committee                  |
| 2027 Q1   | Preferred Bidder   | Heat Co.                               |
| 2028 Q3   | Budget Review 2 – Full cost estimate   | Heat Co.                               |
| 2028 Q2/3 | Full Business Case & Final Investment Decision                                       | Individual Equity Investors and HeatCo |

## 7.11 Risk Management

### 7.11.1 Approach

Project risks are regularly managed, monitored and reviewed. Mitigations and risk ratings are updated as the project is derisked and optimised. Risk Register updates are reported to and reviewed by both the Core and Steering Group. The full Project Risk Register is included as Appendix C.

### 7.11.2 Project closure fallback scenarios

Table 7—9 Project closure scenarios

| Project Stage | DPD  | Commercialisation  |
|---------------|--|--|
| Customer      | Alternative local decarbonisation solution |  |
| Investor      |  | MoA clarifies position, including:<br>Commercial arrangement – the return of any unspent funds goes directly back to Cambridge City Council, as the sole funder of Pre-Commercialisation Stage<br>Legal – dissolution of SPV (if already formed) |
| Developer     |  | Subject to commercial arrangement with developer, if appointed to time of project closure.   |

## 8 References

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