Energy Mapping and Masterplanning
London Borough of Southwark
Presentation of Final Report

April 2019

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Introduction

Drivers for study:

Council's ambition to be carbon neutral by 2030

Aims of study:

- Identify and map the energy requirements of buildings in the borough
- Identify and map the sources of low carbon energy in the borough
- Technically and economically appraise the five best heat network opportunities

Methodology:

- Key steps summarised in table on the right

Energy demands

- Collection of metered energy consumption data
- Review planning energy statements for new developments
- Benchmarking consumption from floor area

GIS mapping

- Energy demands
- Heat sources
- Constraints

Opportunities assessment

- Mapping Workshop
- Council review – five opportunities prioritised

Opportunities development

- Supply technologies appraisal
- Building connections, network routing and energy centre locations
- Site surveys

Modelling

- Economic performance
- Carbon performance

Energy mapping

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Mapping methodology

Arc GIS maps / layers:

- Energy consumption
- Constraints
- Energy sources

Hierarchy for energy consumption values:

- Metered data
- Planning energy statements
- Benchmarking using floor areas

Heating, cooling and electricity consumption maps

- Public buildings and housing stock
- New proposed developments
- Private, commercial, industrial buildings with heating use over 100MWh or housing schemes over 20 units

Constraints mapping

- Listed buildings
- Major roads and bridges
- Under and over-ground railways and stations
- Conservation areas
- Water bodies

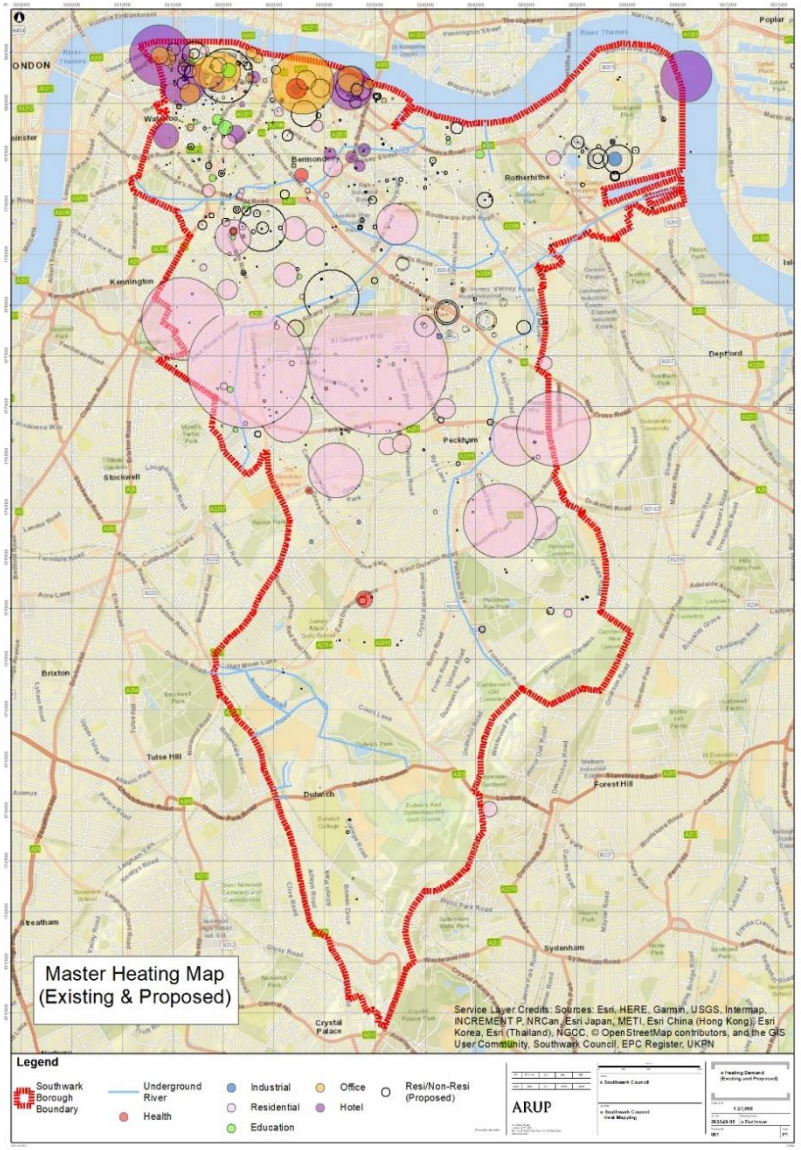
Energy sources

- Rivers, water bodies and sewers
- Waste industrial heat
- Major electricity substations
- Energy from waste and anaerobic digestion plants
- London Underground stations for heat recovery

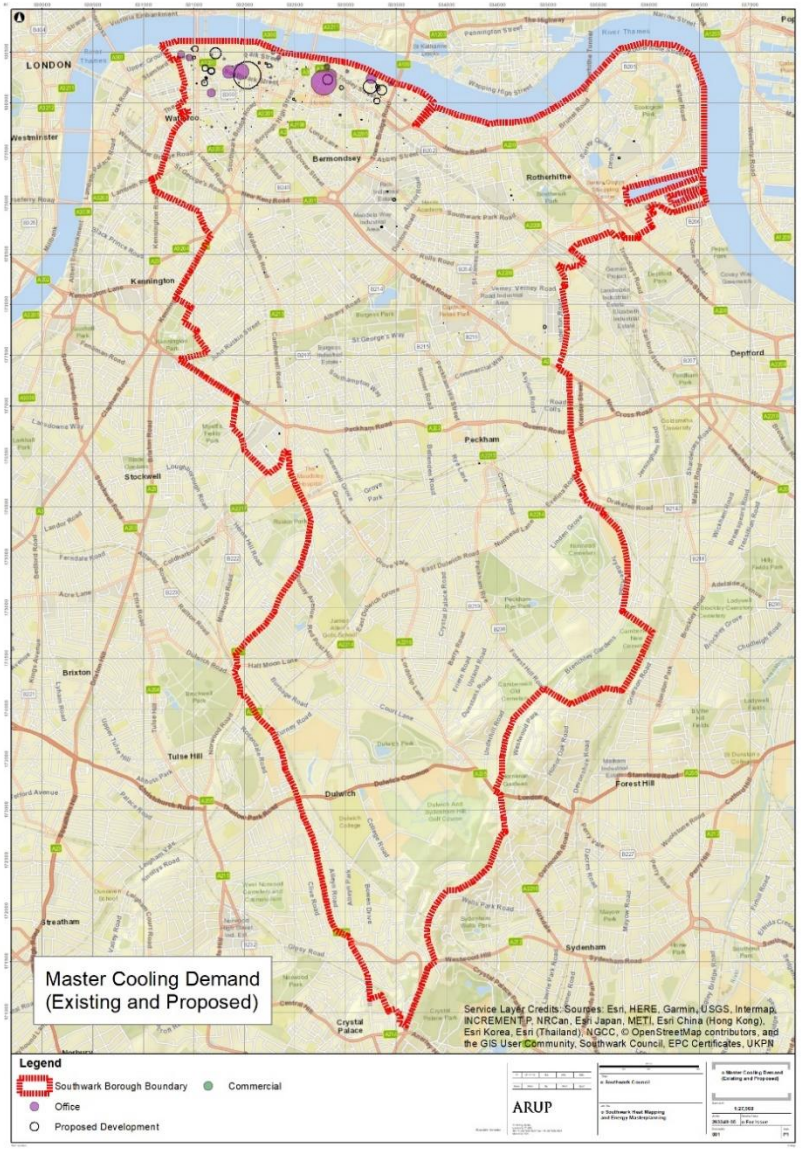
Cluster identification

- 12 areas of interest presented to council at interim Mapping Workshop
- 5 opportunities selected for further appraisal

Heating and cooling demand

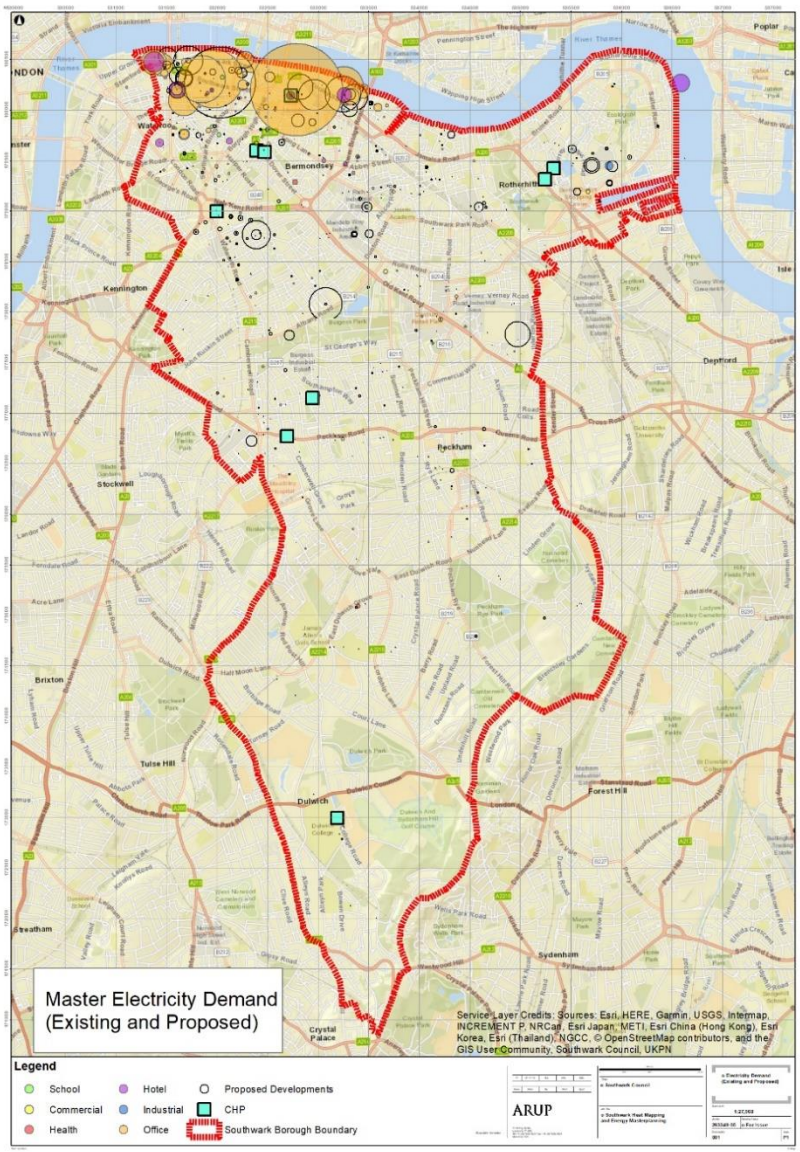


Scaled heating demand in Southwark for various building typologies



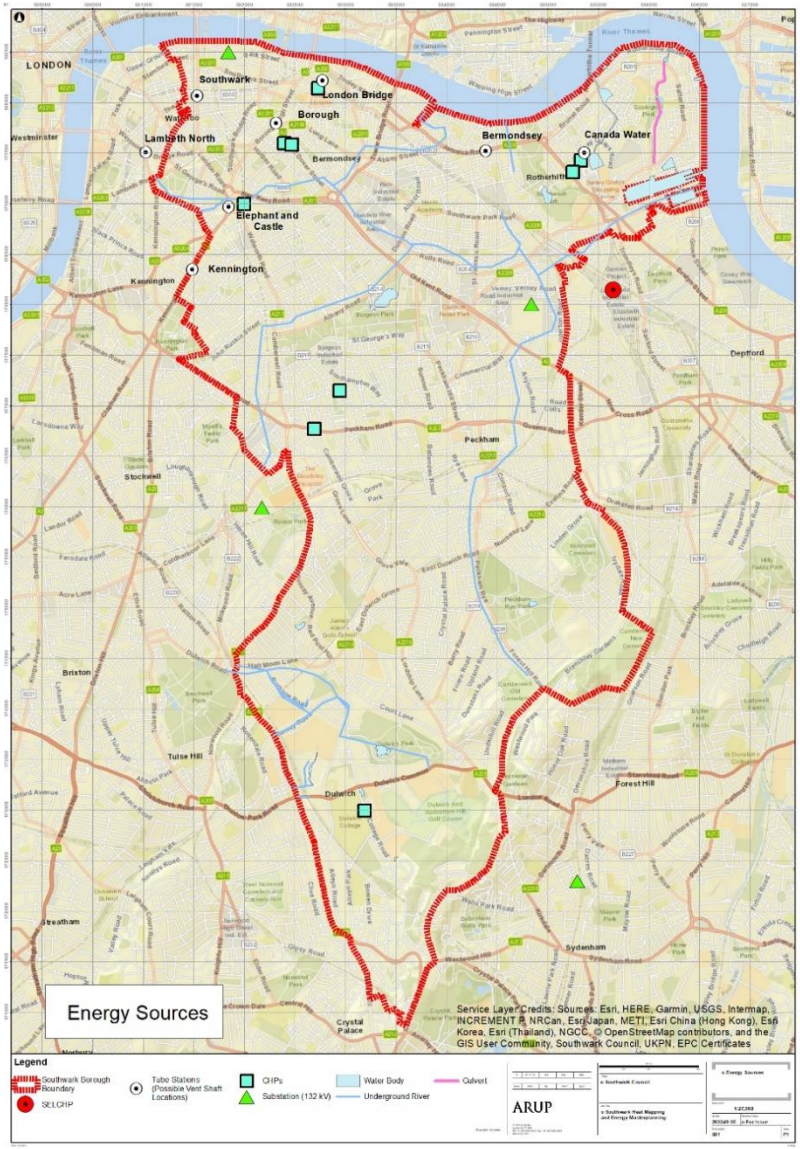
Cooling demand in Southwark

Electricity demand

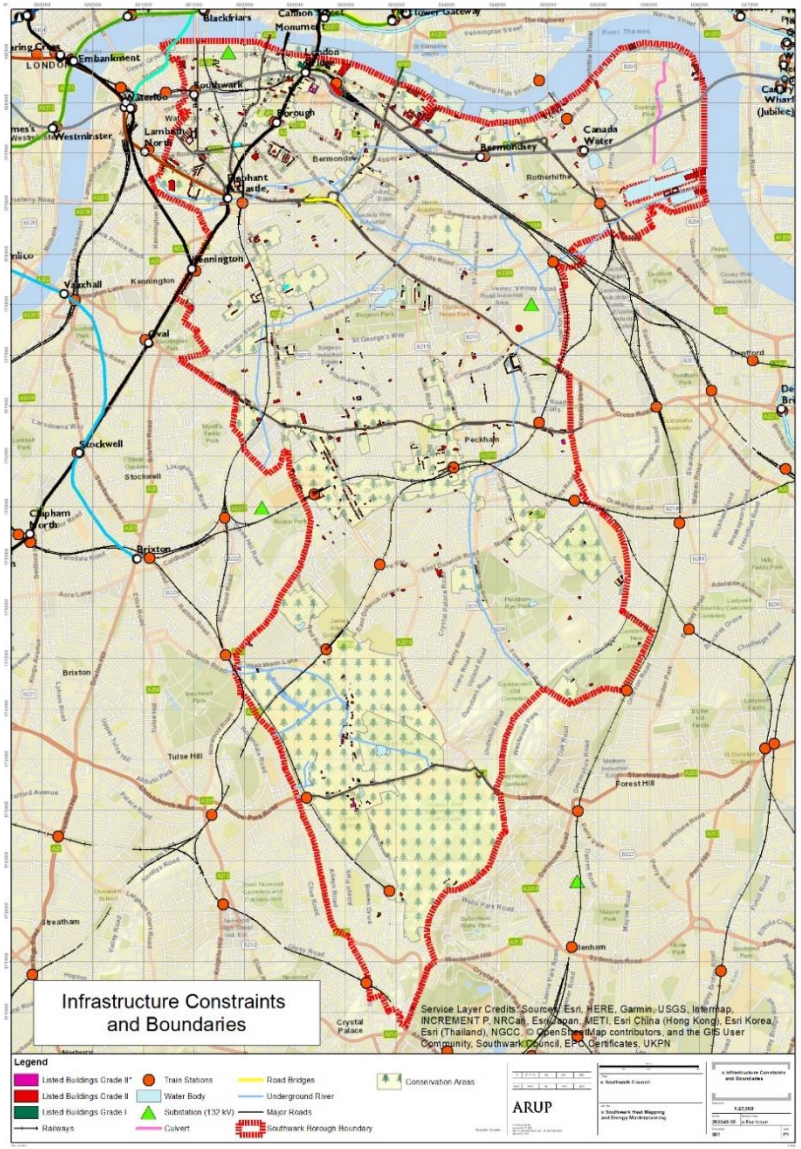


Electricity demand in Southwark including existing CHP locations

Energy sources and constraints



Existing low carbon energy sources in Southwark



Infrastructure constraints for DHN and boundary of LBS

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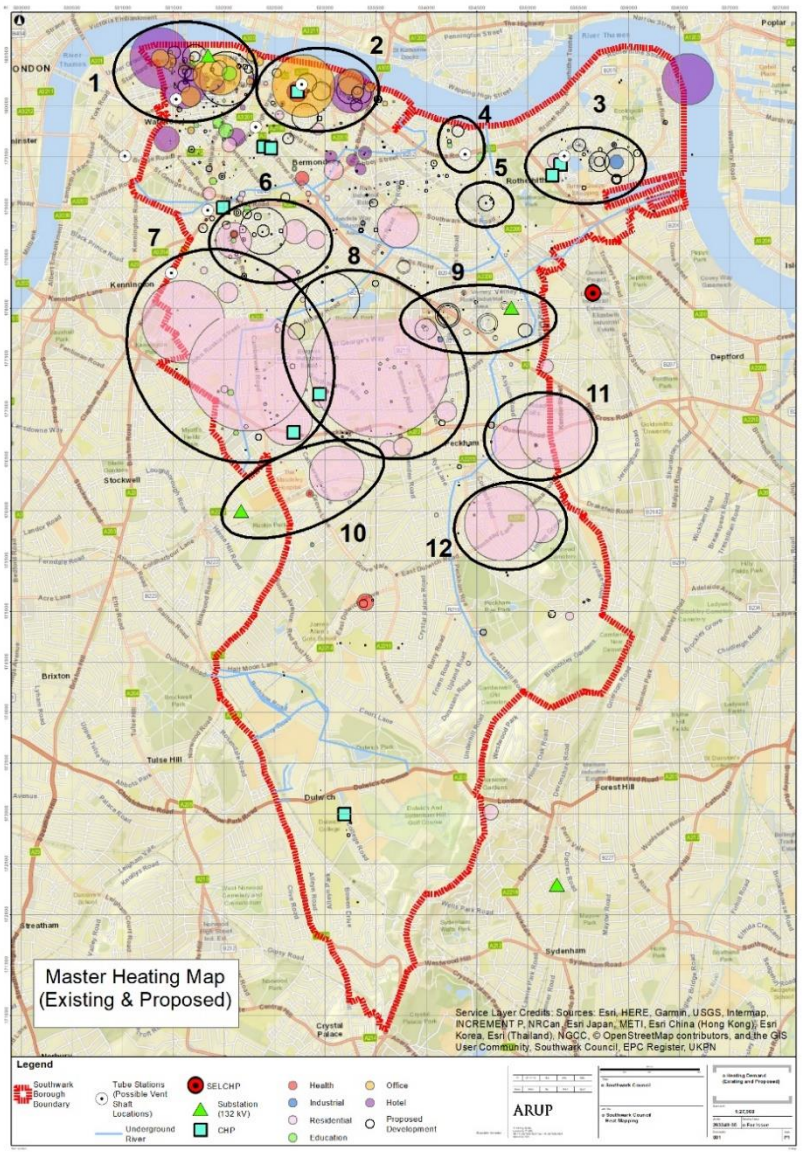
Areas of interest



Identified district heating opportunity areas

Area No.	Low carbon energy source(s)
1	132 kV Substation, River Thames, Southwark Tube Station (Possible Vent Shaft)
2	Existing CHP, River Thames, London Bridge Tube Station (Possible Vent Shaft)
3	Two CHPs, Canada Water Tube Station (Possible Vent Shaft) SELCHP
4	Bermondsey Tube Station (Possible Vent Shaft), Thames
5	SELCHP
6	Elephant Park CHP, large residential output
7	CHP, Kennington Tube Station (Possible Vent Shaft), the Earl's Sluice
8	CHP
9	132 kV substation, SELCHP, Large development site
10	132 kV substation
11	The Peck (underground river)
12	The Peck (underground river)

Summary of identified opportunities

Energy masterplanning: Canada Water

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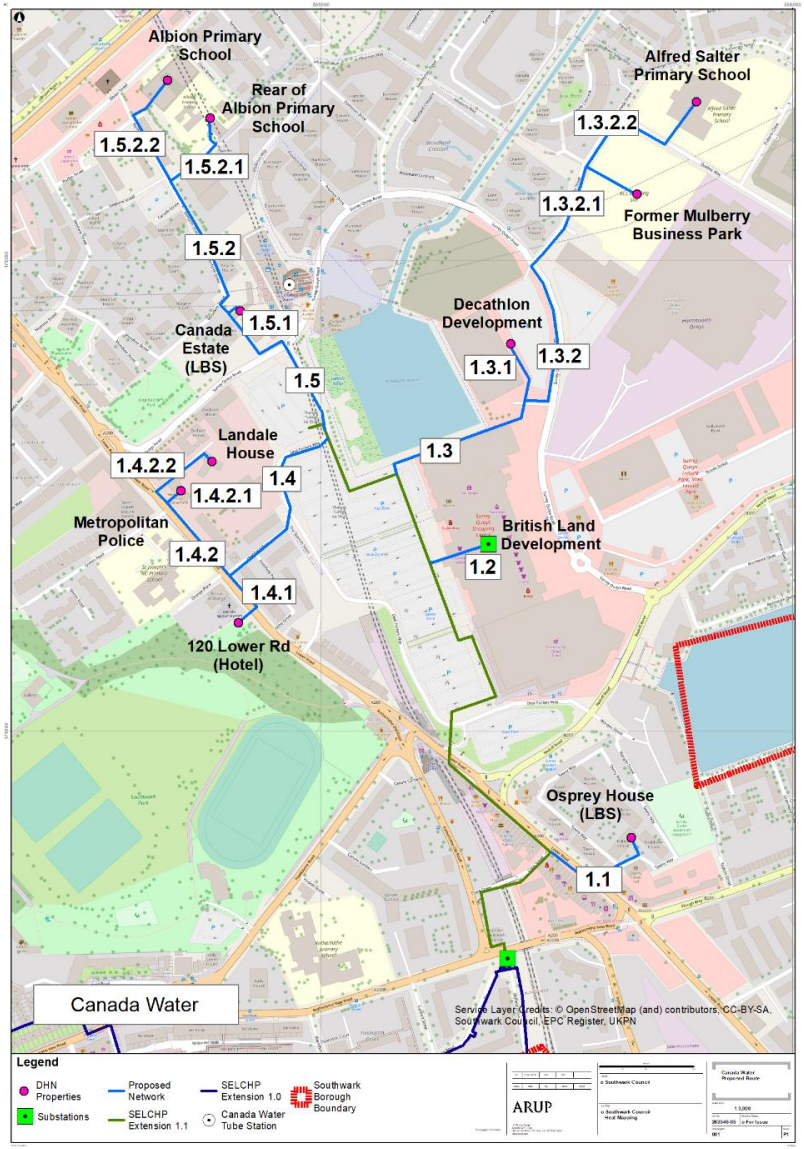
Canada Water Supply options and network routing

Key findings and considerations:

- The council and Veolia have been investigating the feasibility of the extension of the ‘SELCHP 1.0’ pipework north into Canada Water.
- ‘SELCHP 1.1’ would serve the proposed British Land development as well as Osprey Estate and later, the Canada Estate.
- SELCHP 1.1 could be extended to serve other loads
- British Land development is lion’s share of heat demand in cluster – planning application included heat pump solution for heating (i.e. not connecting to SELCHP)
- Planning dept/GLA says current energy strategy doesn’t comply with policy
- There should be a push to connect British Land development to SELCHP due to offsite benefits.



SELCHP proposed network routing

Canada Water Results

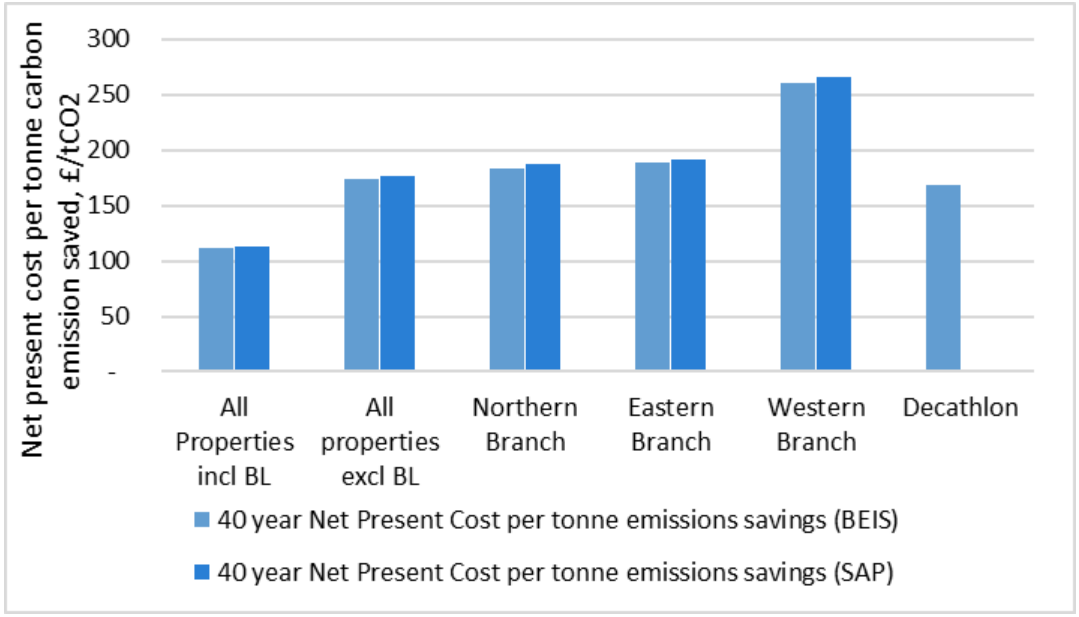
Key Risks

- Whether the SELCHP 1.1 pipe is installed initially to serve Osprey Estate, the Canada Estate and the new British Land development.
- Heat offtake available capacity after the British Land development.

Next steps

- Condition the British Land development to connect to SELCHP through planning.
- Work with the developer of the Decathlon development to promote connection to the network.

	All Properties incl BL	All properties excl BL	Northern Branch	Eastern Branch	Western Branch	Decathlon
Total Capital Costs (£)	£12,204,116	£5,035,340	£1,455,727	£2,114,117	£1,027,064	£893,033
Average Annual Heat Demand (kWh)	62,125,726	13,015,382	2,843,940	6,441,277	719,571	5,525,586
Tonnes of CO2 saved over scheme lifetime (BEIS) (tCO2) over 40 years	461,768	96,741	21,138	47,877	5,348	41,071
40 year pre-tax IRR	14.7%	No return	No return	0.7%	No return	11.4%
40 year pre-tax NPV (6% discount rate)	£10,079,791	-£4,225,686	-£1,886,837	-£807,716	-£734,400	£225,133
40 year pre-tax Net Present Costs	£51,257,059	£16,818,618	£3,880,169	£9,031,085	£1,395,671	£6,895,576



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Energy masterplanning: Elephant & Castle

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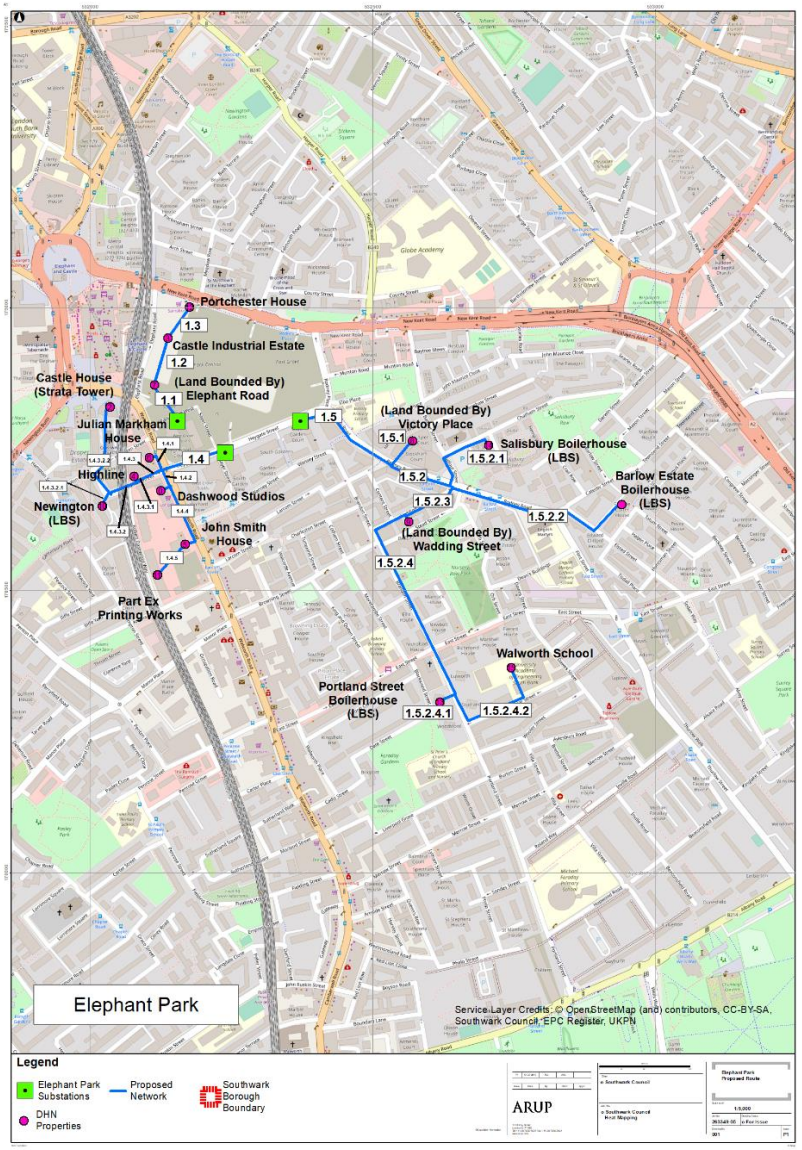
Elephant & Castle Supply options & network routing

Key findings and considerations:

- Elephant Park network has c. 6,5GWh additional heat offtake capacity; could extend existing network
- Network operated by E.ON; they are keen to sell the remaining available heat
- 60% of heat in network met by CHP, remainder gas boilers
- CHP heat offset with biomethane purchasing
- Three pipe branches identified
- Walworth Road and railway present significant barrier to pipework installation



Elephant Park proposed network routing

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Elephant & Castle Results

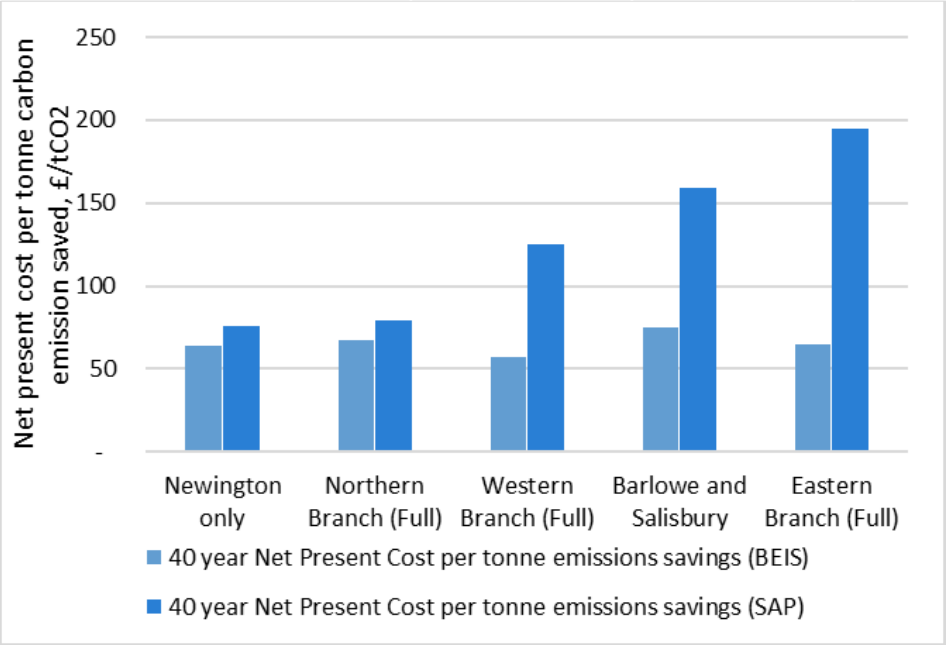
Key Risks

- Heat capacity availability. E.ON are in discussions with Elephant and Castle shopping centre redevelopment
- Routing the pipework across Walworth Road and under the railway
- Cost of heat
- HNIP funding eligibility

Next steps

- Engage with E.ON and Lendlease
- Determine E.ON's heat pricing tariffs
- Stay abreast of Aylesbury Estate redevelopment. Potential to expand Aylesbury network in future?

	Newington only	Northern Branch (Full)	Western Branch (Full)	Barlowe and Salisbury	Eastern Branch (Full)
Total Capital Costs (£)	£1,057,574	£1,104,615	£2,401,812	£5,244,626	£6,330,271
Average Annual Heat Demand (kWh)	5,472,508	5,057,055	14,283,994	13,726,067	22,882,701
Tonnes of CO2 saved over scheme lifetime (BEIS) (tCO2) over 40 years	71,019	65,628	185,370	178,130	296,959
40 year pre-tax IRR	No return	13.8%	4.9%	No return	5.8%
40 year pre-tax NPV (6% discount rate)	-£2,246,116	£743,243	-£255,403	-£5,447,859	-£98,618
40 year pre-tax Net Present Costs	£4,546,116	£4,422,979	£10,607,336	£13,306,702	£19,281,248



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Energy masterplanning: Kennington

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Kennington Supply options and network routing

Key findings and considerations:

- Includes one of Southwarks largest heating demands, the Brandon Estate (12.4GWh/annum)
- Heat offtake from new LU Northern Line head house located in Kennington Park (part of Lambeth)
- C. 1MW Heat pump used to step up temperatures
- Utilises waste heat if ventilation shaft is in extract mode, or provide cooling to LU in supply mode
- Extract air typically 20°C+
- Could supply up to 40% of Brandon demand
- Location of plant on TfL land required

Kennington proposed network routing

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Kennington Results

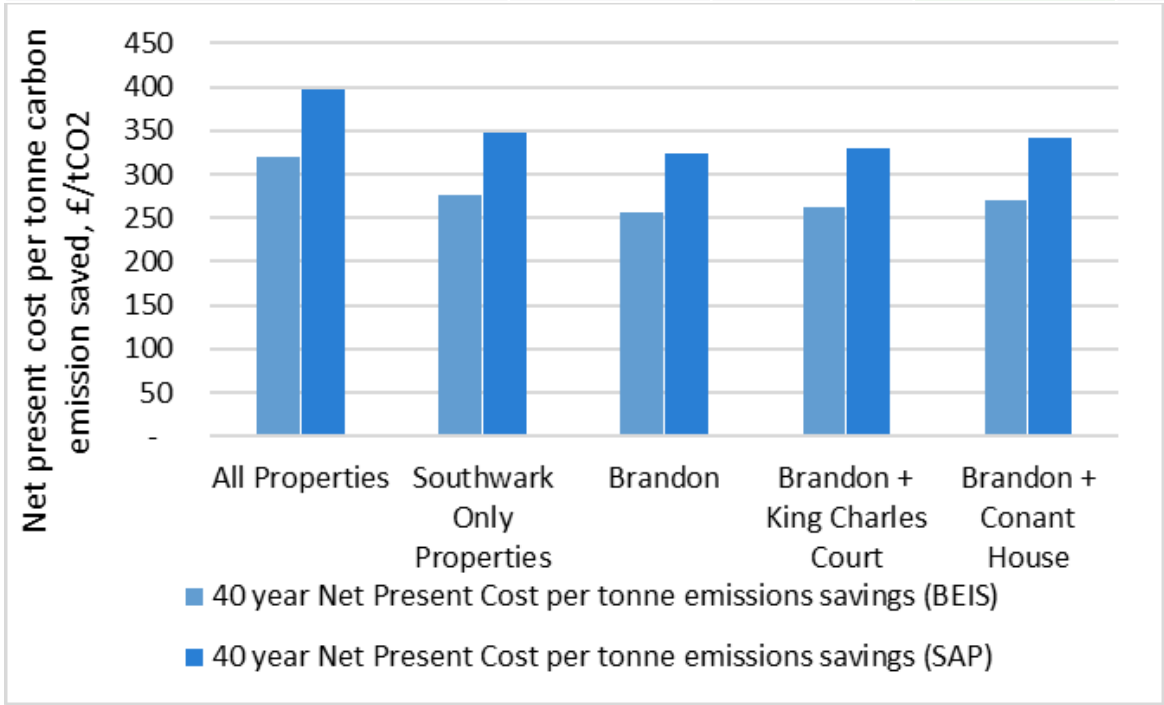
Key Risks

- No RHI eligibility
- The availability of heat
- Engagement/negotiation with TfL
- Phasing with the construction of the new vert shaft, which is underway already
- High supply temperatures, low COP

Next steps

- Engage with TfL to understand the feasibility
- Determine reduction of supply temperatures
- Energy efficiency measures such that the heat pump would be able to meet 50% of the demand, opening the scheme to HNIP funding

	All Properties	Southwark Only Properties	Brandon	Brandon + King Charles Court	Brandon + Conant House
Total Capital Costs (£)	£5,177,543	£4,121,848	£3,758,612	£3,846,823	£4,033,637
Average Annual Total Heat Demand (kWh)	17,730,132	14,493,785	12,437,543	12,991,567	13,939,761
Tonnes of CO2 saved over scheme lifetime (BEIS) (tCO2) over 40 years	48,412	46,635	45,506	45,810	46,331
40 year pre-tax IRR	No return	No return	No return	No return	No return
40 year pre-tax NPV (6% discount rate)	-£7,139,657	-£7,156,650	-£6,834,206	-£6,884,602	-£7,106,254
40 year pre-tax Net Present Costs	£15,465,597	£12,883,915	£11,660,970	£11,977,556	£12,567,329



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Energy masterplanning: Camberwell

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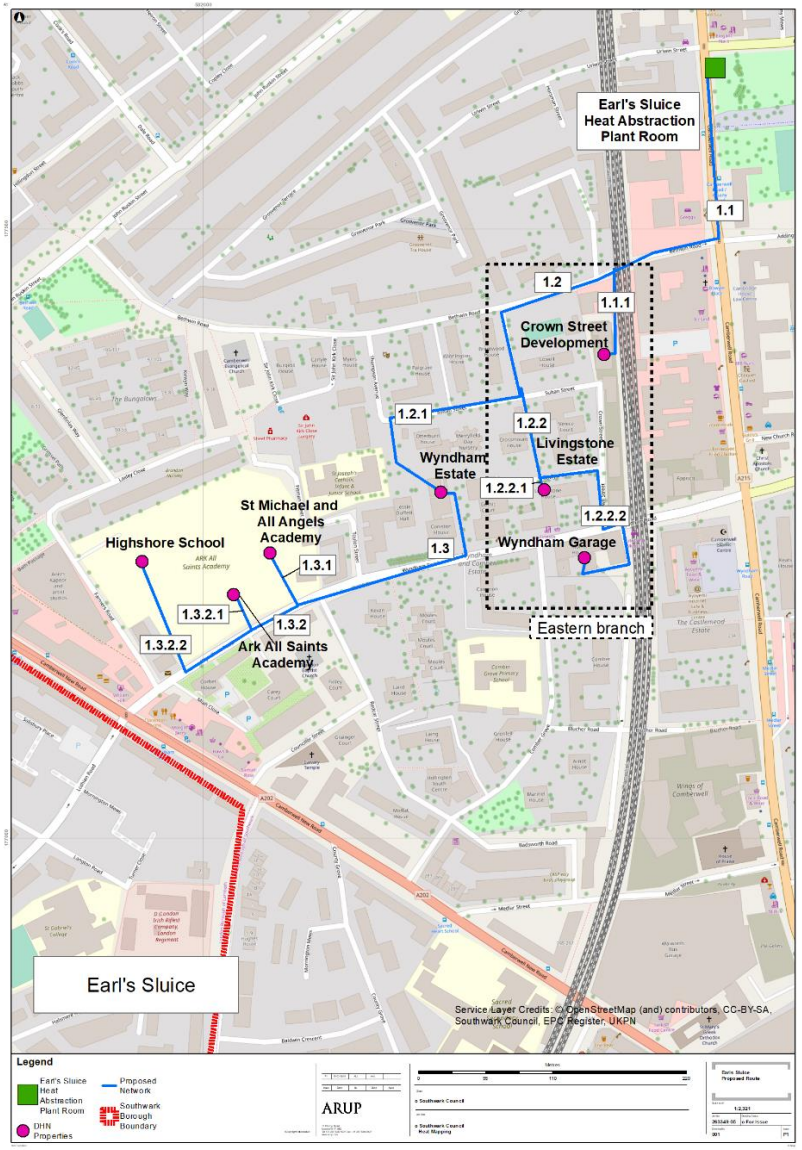
Camberwell Supply options and network routing

Key findings and considerations:

- Cluster contains Wyndham Estate, one of Southwarks largest heat demands (c. 18.0GWh/annum)
- Earl's Sluice, combined sewer/buried river runs up Walworth Road
- Potential sewer source heat pump plant located at junction of Walworth Road and Albany Road
- C. 1.6MW heat pump output based on flow rates
- Thames Water would charge for low grade heat
- Walworth Road and railway present significant pipework routing barriers
- Heat pump could serve c. 40% of Wyndham demand
- Since the heat output of the heat pump is limited by the flow rate in the sewer, the carbon emission savings are similar between all scenarios.



Camberwell proposed network routing

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Camberwell Results

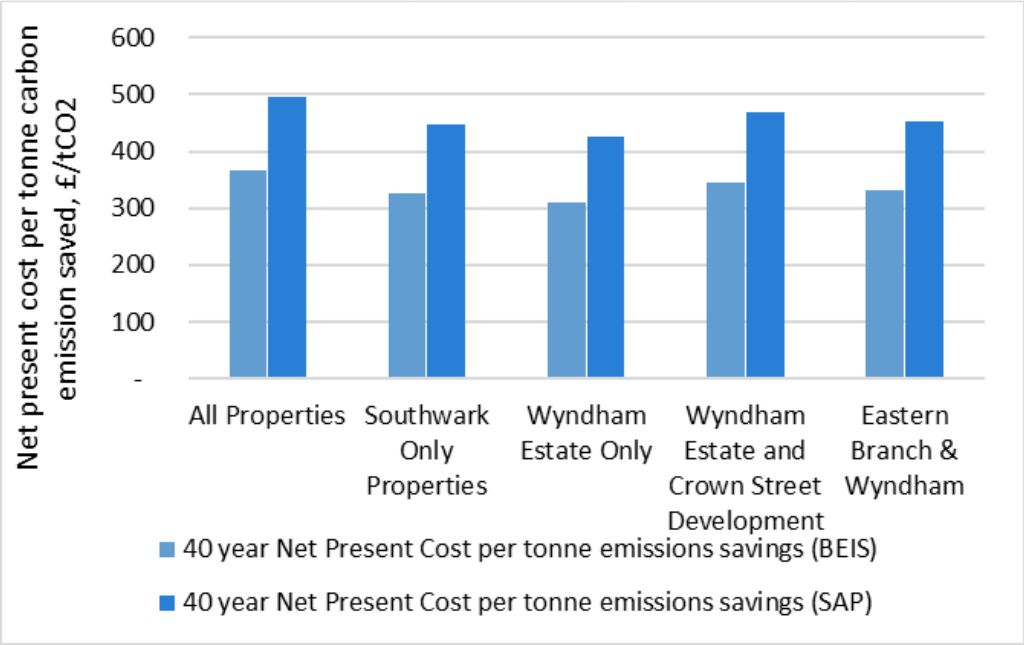
Key Risks

- RHI scheme
- Location of sump/EC
- Engagement of Thames Water
- Routing pipework
- Use of Burgess Park to house the energy centre/plant.
- High heating supply temps

Next steps

- Reduction of heating supply temps
- Engage with a sewer heat recovery supplier
- Energy efficiency measures to bring low carbon heat supplied to 50% (HNIP requirement)
- Review alternative options

	All Properties	Southwark Only Properties	Wyndham Estate Only	Wyndham Estate and Crown Street Development	Eastern Branch & Wyndham
Total Capital Costs (including sensitivity)	£8,203,653	£6,819,267	£6,180,825	£7,371,458	£7,013,020
Total Heat Demand (kWh)	21,582,502	18,695,501	18,084,501	20,695,987	18,971,015
Tonnes of CO2 saved over scheme lifetime (BEIS) (tCO2) over 40 years	58,491	56,905	56,570	58,004	57,057
40 year pre-tax IRR	No return	No return	No return	No return	No return
40 year pre-tax NPV (6% discount rate)	-£6,624,377	-£6,818,349	-£6,648,043	-£6,523,109	-£6,749,311
40 year pre-tax Net Present Costs	£21,404,207	£18,545,906	£17,507,714	£20,017,739	£18,894,182



Energy masterplanning: North Peckham

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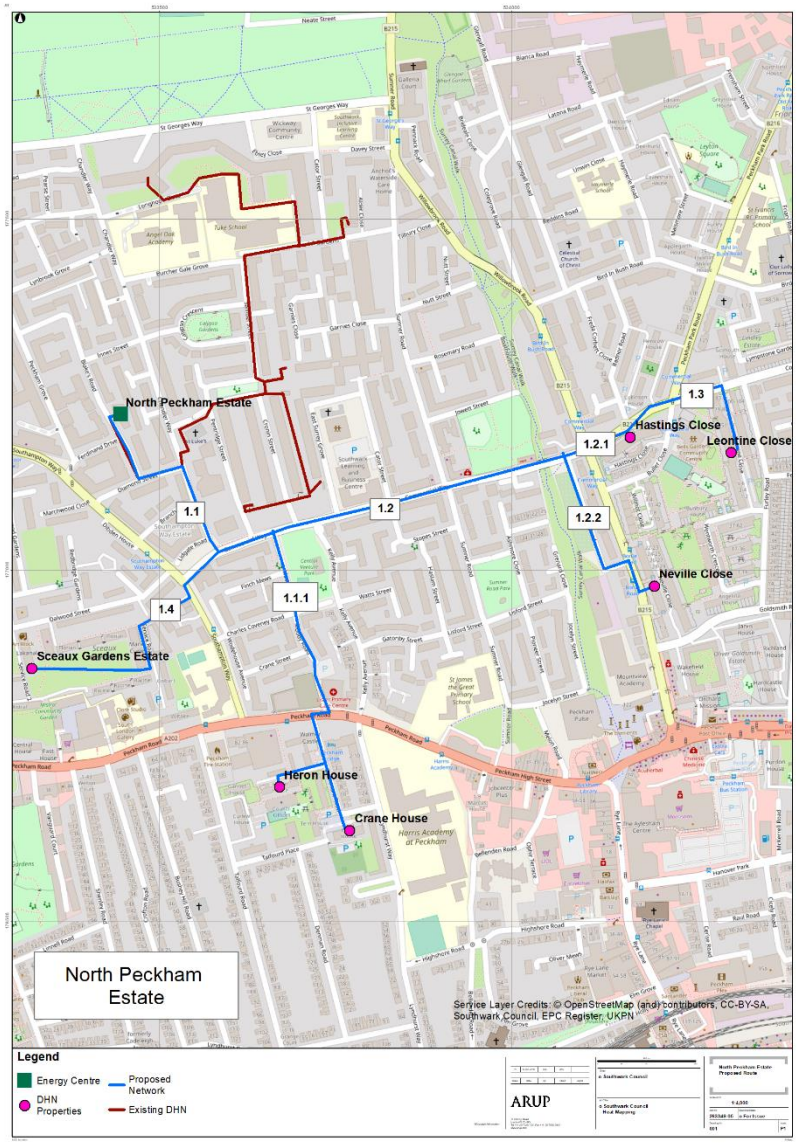
North Peckham Supply options and network routing

Key findings and considerations:

- Cluster contains North Peckham Estate, Southwark's largest heat demand (c. 17.3 GWh/annum)
- No low carbon heat sources in the area
- Conducted a low carbon heat supply technology appraisal
- Gas CHP chosen technology for decarbonisation (c. 2MWth engine size)
- Located in North Peckham energy centre on Blake's Road, assuming one boiler can be decommissioned
- Investigated feasibility of extending network to serve other nearby loads
- No private wire opportunities identified – electricity to be exported



North Peckham proposed network routing

North Peckham Results

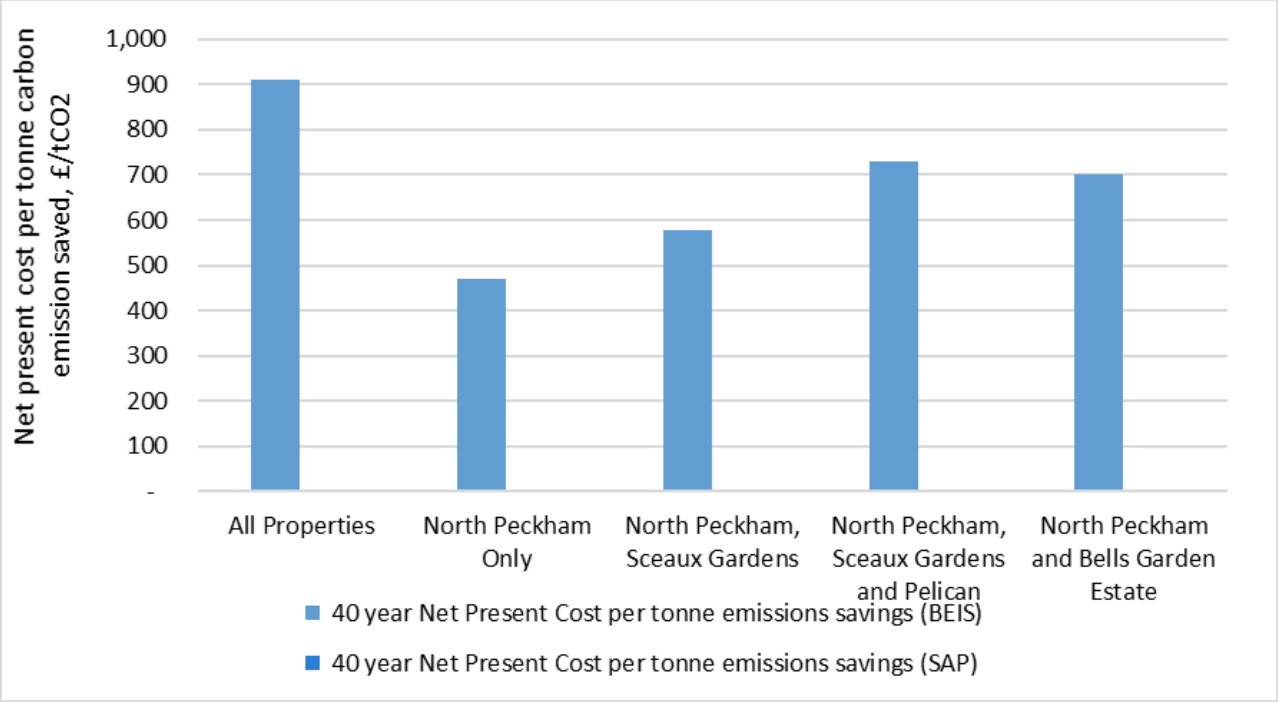
Key Risks

- air quality implications
- ability to export generated power
- that one of the 4no. existing 5MW gas boilers on site can be decommissioned
- Space availability in existing plant room
- noise implications
- thermal storage capacity

Next steps

- Install heat meters
- Check that the demands do not exceed 10MW at peak.
- Understand requirements of dual fuel storage tanks

	All Properties	North Peckham Only	North Peckham, Sceaux Gardens	North Peckham, Sceaux Gardens and Pelican	North Peckham and Bells Garden Estate
Total Capital Costs (£)	£9,550,393	£2,092,625	£4,367,482	£6,444,359	£6,225,636
Average Annual Heat Demand (kWh)	£33,243,940	£17,343,312	£20,084,033	£25,802,626	£24,784,627
Tonnes of CO2 saved over scheme lifetime (BEIS) (tCO2) over 40 years	48,919	43,088	44,093	46,190	45,817
40 year pre-tax IRR	No return	No return	No return	No return	No return
40 year pre-tax NPV (6% discount rate)	-£8,669,555	-£1,474,355	-£3,834,148	-£5,797,594	-£5,404,635
40 year pre-tax Net Present Costs	£44,583,675	£20,210,696	£25,531,347	£33,672,707	£32,179,983



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Conclusions and next steps

Conclusions

- All opportunities present carbon savings – use of SELCHP is biggest opportunity
- Assessing projects in isolation may be misleading
- Heat pump options could be improved through supply temperature reduction
- Low carbon heat is more expensive than the current Business as Usual case for Southwark, due to council's low gas price

	Canada Water	Elephant and Castle	Camberwell	Kennington	North Peckham
Total Capital Costs (£)	£12,204,116	£1,104,615	£6,180,825	£3,758,612	£2,092,625
Average Annual Heat Demand (kWh)	62,125,726	£5,057,055	18,084,501	£12,437,543	£17,343,312
Tonnes of CO2 saved over scheme lifetime (BEIS) (tCO2) over 40 years	461,768	65,628	56,570	45,506	43,088
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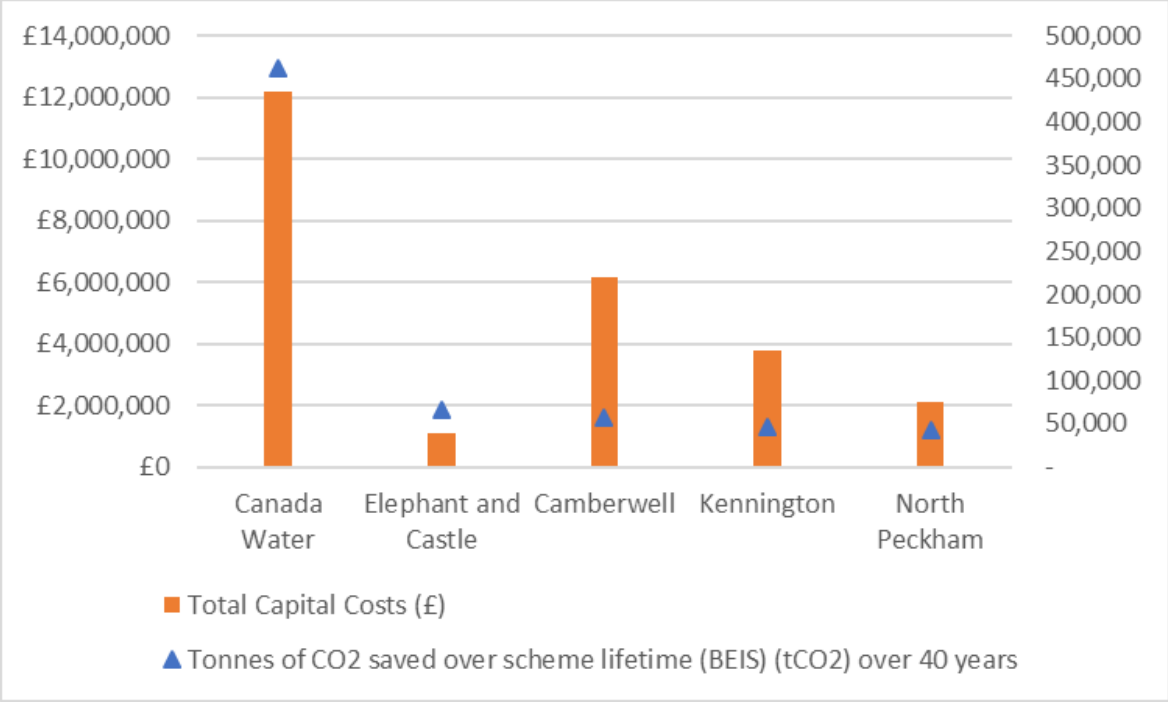

Next steps

Recommendations:

- All 5 opportunities should be explored further
- Council should explore if heat pumps efficiencies can be improved through reduction of supply temperatures

Additional considerations:

- Incentives for residents to use less heat
- Energy efficiency measures on Southwark Council networks

Next steps:

- Summarised on the right

Critical unanswered questions

- Effects of Southwark specific nuances, eg SELCHP royalties, a detailed counterfactual
- LU heat availability at Kennington Park
- Peak heating demand on networks. Heat metering to better understand heat demands and consumption patterns
- Ability to reduce network supply temperatures

Engagement with stakeholders

- E.ON and Lendlease (Elephant Park)
- Thames Water / technology supplier like SHARC Energy (Camberwell)
- TfL (Kennington)
- British Land (Canada Water developer)
- Veolia (SELCHP operator)

Feasibility

- HNDU feasibility studies for options the council want to proceed with

Thank you.

For further information please contact:

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