Shoreham Harbour Heat Network Study

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Shoreham Harbour Heat Network Study - S0653	03	11/04/2016	Gabriel Gallagher, Lee Evans and Penny Challans	Chrissy Woodman, Gillian Dyer and Poul Weiss

EXECUTIVE SUMMARY

This report presents the findings of the Shoreham Harbour Heat Network Study (2015). The project partners include Brighton and Hove City Council, Adur District Council, Shoreham Port Authority and Edgeley Green Power Ltd (EGP) with support from West Sussex County Council and the Heat Network Delivery Unit (HNDU) of the Department of Energy and Climate Change (DECC). The work was conducted by Sustainable Energy Ltd (SEL) in partnership with COWI and Carbon Trust. SEL managed the project and undertook the majority of analysis and report writing. Carbon Trust provided key inputs addressing prioritisation, planning, financial assessment and governance models and COWI provided technical information, strategic support and technical review services.

The study has been undertaken for two reasons: to inform local planning policy, in particular the Shoreham Harbour Joint Area Action Plan (JAAP); and in response to the opportunity to deliver district heating from Shoreham Port, presented by the planned development of a 32MW power station, Edgeley Green Power Station (EGPS) on the South Quayside. The study explores potential heat networks that could be fed by EGPS as well as the potential for heat network delivery through other heat delivery means. The Study has been funded mainly by DECC via the HNDU.

The study considers viability and assesses risk for district energy network options under two scenarios: scenario A where EGPS provides heat to three large phased network options; and scenario B where EGPS is not developed and other heat sources provide heat to five potential network phases. EGPS could provide a significant opportunity to develop a large heat network that may have the potential to reduce energy costs and/or generate revenue[1] (business model dependant), reduce carbon emissions, promote development opportunities and help alleviate fuel poverty in the area.

Data collection and review
The first stage of the work involved a review of previous district heating studies and a detailed data collection exercise that required site visits, meetings, telephone calls and email correspondence. Building energy data and other relevant information was collected from the project partners, other stakeholders and mapping data bases. A low number of responses were received from potential heat loads in the private sector and historical energy data was not available for Adur Homes.

Energy demand assessment
Heat demand models were produced for key potential heat loads and the resultant demand profiles were combined to assess the overall heat demand for different sized heat clusters and network options. Electricity demands were assessed in order to investigate options for private wire arrangements. The majority of heat demands are located to the north of the River Adur and canal basin and the planned developments along the Western Harbour Arm have the highest potential heat density. In other areas there is a relatively low linear heat density as many of the heat demands are small and inconsistent and do not provide potential key anchor loads (large consistent heat demands) for a heat network. Without these, network viability relies on scale i.e. a large number of small heat demands.

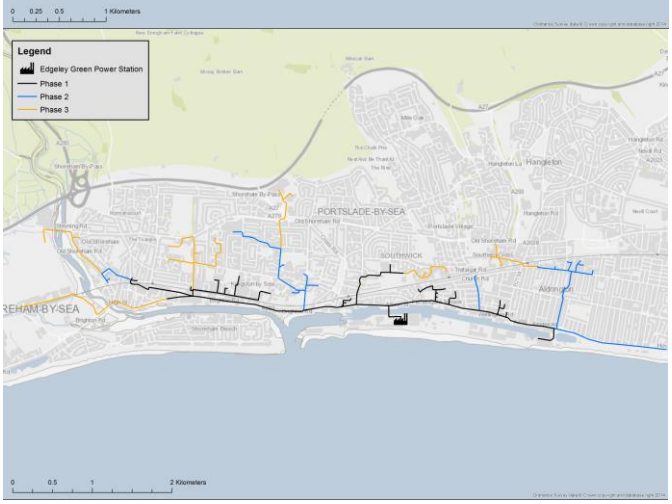
Summary of priority network options
After an initial assessment of heat demands, pipe routes and heat sources, a number of network phase options were selected for more detailed assessment. Network options were explored under the two scenarios described above. Scenario A considered network options connected to EGPS and scenario B explored alternative heat source technologies and included marine source heat pumps, biomass boilers, gas CHP and biofuel CHP. Phases for each scenario (where potentially viable), and the timing of development phases were then produced. Potentially viable network options were then identified and these are summarised in the table below.

[1] As district energy networks are rateable assets (under business rates), and local authorities can collect and retain 100% of rates from renewable energy schemes, there is potentially a further incentive to promote delivery of district energy networks in Shoreham.

Scenario	Phase	Network trench length	Total heat demand	Peak demand	No. of heat loads	Potential delivery date
A – Edgeley Green Power	1	12.5 km	57,003 MWh	22 MW	201	2020
	2	19.5 km	92,405 MWh	36 MW	274	2020
	3	29 km	133,143 MWh	52 MW	384	2035
B – Alternative Heat Sources	1a	1.7 km	17,306 MWh	8 MW	32	2020
	1b	6.4 km	32,296 MWh	13 MW	97	2020
	2	7.3 km	48,581 MWh	17 MW	122	2035
	3	13 km	71,699 MWh	25 MW	215	2035
	4	21 km	106,975 MWh	36 MW	288	2035

The potential network routes and summaries for Scenarios A and B are shown below:

Scenario A



Scenario A Phase 1 Network Summary (EGPS)	
Network trench length	12.5 km
Total heat demand	57,003 MWh
Peak demand	22 MW
Number of heat loads	201
Potential delivery date	2020
Network heat loss	12%

Priority heat loads:
- Western Harbour Arm Flats 1, 2, 9, 10, 21 planned developments
- Adur Civic Centre redevelopment
- South Portslade residential development 1.1
- Vega social housing

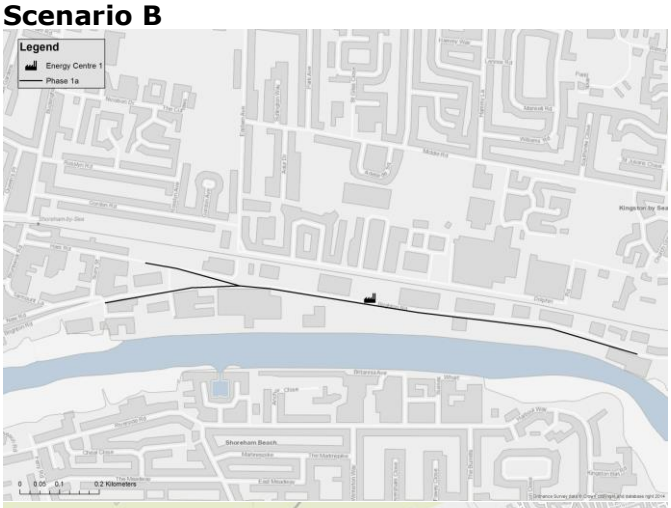
Scenario A Phase 2 Network Summary (EGPS)	
Network trench length	19.5 km
Total heat demand	92,405 MWh
Peak demand	36 MW
Number of heat loads	274
Potential delivery date	2020
Network heat loss	12%

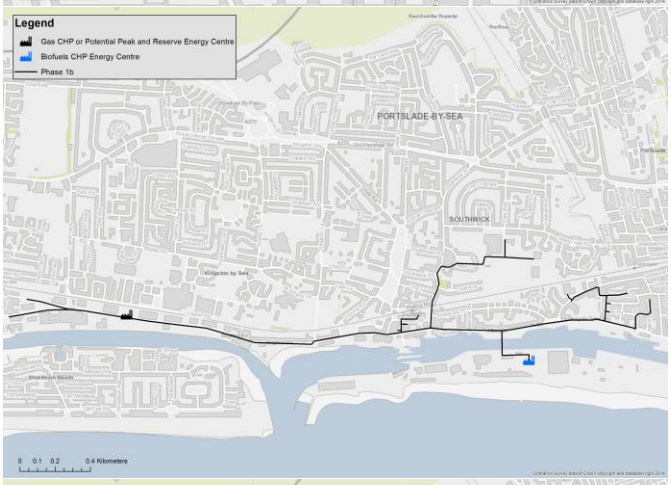
Priority heat loads include phase 1 plus:
- King Alfred Leisure Centre planned development
- Shoreham Academy
- Steven's Court social housing
- Southlands residential development
- Southlands Hospital

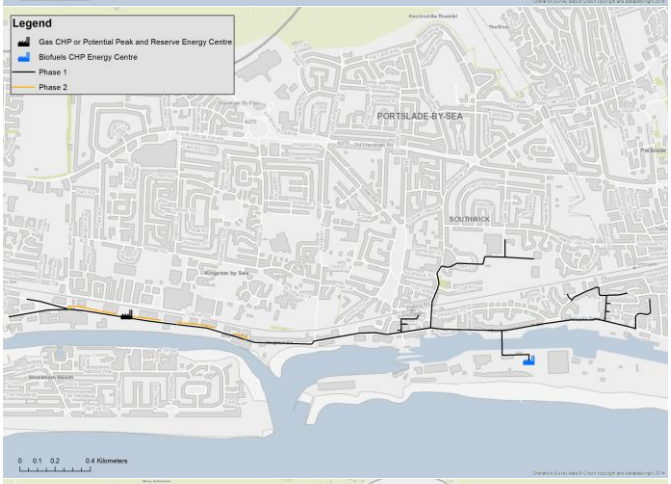
Scenario A Phase 3 Network Summary (EGPS)	
Network trench length	29.0 km
Total heat demand	133,143 MWh
Peak demand	52 MW
Number of heat loads	384
Potential delivery date	2035
Network heat loss	12%

Priority heat loads include phase 2 plus:
- 79-81 Brighton Road

Scenario B







Scenario B Phase 1a Network Summary (Gas CHP)	
Network trench length	1.7 km
Total heat demand	17,306 MWh
Peak demand	8 MW
Number of heat loads	32
Potential delivery date	2020
Network heat loss	5%

Priority heat loads:

- Western Harbour Arm Flats 1, 2, 5, 6, 9, 10 & 21 planned developments
- Adur Civic Centre redevelopment

Scenario B Phase 1b Network Summary (Biofuels CHP)	
Network trench length	6.4 km
Total heat demand	32,296 MWh
Peak demand	14 MW
Number of heat loads	97
Potential delivery date	2020
Network heat loss	10%

Priority heat loads include phase 1a plus:

- Eastbrook Primary Academy (north site)

Scenario B Phase 2 Network Summary (Biofuels CHP)	
Network trench length	7.3 km
Total heat demand	48,581 MWh
Peak demand	17 MW
Number of heat loads	122
Potential delivery date	2035
Network heat loss	7%

Priority heat loads include phase 1 plus:

- 79-81 Brighton Road
- Western Harbour Arm (phase 3) flats 7 & 10

Scenario B Phase 3 Network Summary (Biofuels CHP)	
Network trench length	13.0 km
Total heat demand	71,699 MWh
Peak demand	25 MW
Number of heat loads	215
Potential delivery date	2035
Network heat loss	9%

Priority heat loads include phase 2 plus:

- South Portslade residential development 1.1

Scenario B Phase 4 Network Summary (Biofuels CHP)	
Network trench length	21.0 km
Total heat demand	106,975 MWh
Peak demand	36 MW
Number of heat loads	288
Potential delivery date	2035
Network heat loss	10%

Priority heat loads include phase 3 plus:

- King Alfred Leisure Centre planned development
- Stevens Court
- Shoreham Academy
- Southland's Hospital residential development

The table below summarises the high level financial viability of the network options selected for further assessment.

Scenario	Phase	Heat source	Estimated Capital Costs	25 Year Financial Case			Annual Carbon Saving (tonnes)	Risk level
				Payback	IRR	NPV		
A	1	EGPS	£18,289,822	13 years	7%	£8,271,631	11,131 tCO_2	High
	2		£28,351,373	13 years	7%	£15,197,019	18,040 tCO_2	High
	3		£38,994,806	13 years	7%	£20,925,870	24,968 tCO_2	High
B	1a	Gas CHP	£5,027,405	12 years	8%	£3,393,328	3,700 tCO_2	High
	1b	Biofuel CHP	£8,869,164	11 years	9%	£6,798,594	6,459 tCO_2	High
	2	Biofuel CHP	£9,856,177	8 years	13%	£14,855,413	10,042 tCO_2	High
	3	Biofuel CHP	£17,352,885	10 years	10%	£17,617,009	14,396 tCO_2	High
	4	Biofuel CHP	£26,746,217	11 years	9%	£23,032,923	20,548 tCO_2	High

All options considered present 'high risk' opportunities as the high level financial cases for the phase 1 schemes have IRRs of less than 10%, this is likely to restrict financing opportunities. Private sector developers would require IRRs well in excess of 10%, therefore options are only likely to be viable if developed by, or with financial support from EGPS, with a grant, or with a mix of grant funding and public sector borrowing.

Scenario A - summary

The most likely scenario for development occurs under scenario A where EGP drive, finance or incentivise the development of a large network in order to receive the benefits associated with achieving certification as Good Quality CHP[2]. If EGPS is developed without an associated heat network, the local authorities may receive criticism and reputational damage for failing to facilitate a network development if the potentially low carbon, low cost heat resource is perceived as being wasted.

In these circumstances, the project partners can play an important facilitating role but will need to undertake a series of corporate actions to promote and enable the scheme. These actions could include facilitating engagement between key stakeholders, providing land for energy centres and pipe routes,

[2] CHPQA (Combined Heat & Power Quality Assurance) is a voluntary UK government scheme to encourage the development of Good Quality CHP Schemes. If a specified required quantity of useful heat can be provided to a network then CHPQA accreditation will allow EGP to claim: an uplift from 1.5 to 2 ROCs per MWh of output generation; Enhanced Capital Allowances (ECAs); exemption from the Climate Change Levy (CCL); and potential business rates exemptions.

committing to long term purchasing contracts, providing planning support, including heat networks in planning policy and/or energy strategies, encouraging heat intensive businesses (potential key anchor loads) to locate in the vicinity and providing resource and financial assistance.

Scenario B - summary
If EGPS is not developed, district heating opportunities are significantly reduced. There is a high risk opportunity to develop the small scenario B phase 1a, gas CHP embryo network. There may be limited opportunities to attract private finance due to the low IRR and risk associated with engaging with developers and securing private wire arrangements with private residential users.

Therefore the scheme will only be a viable proposition with a grant or a mix of grant funding and public sector borrowing. Phase 1a is likely to be the only small, potentially viable scheme in the heat map area and may be progressed by local community energy groups with the proposed Sussex Energy Tariff providing important contributions towards progressing the scheme and engaging with end users.

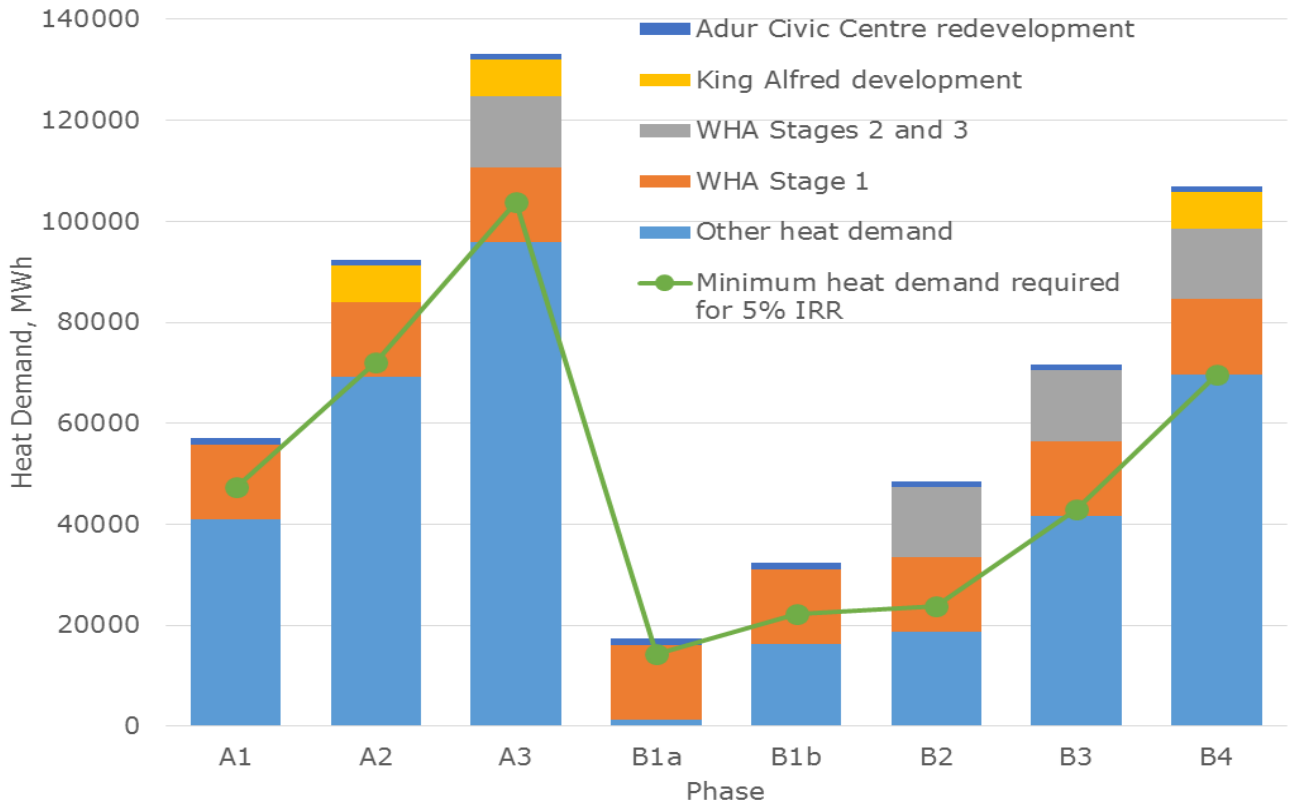
If Edgeley Green Power Station is not developed, a biofuel CHP plant provides the most likely source of low cost, low carbon heat for a larger network under Scenarios B 1b, 2, 3 and 4 based on the high level techno-economic evaluation undertaken in this study. The project partners may provide an enabling role to promote the site to other organisations but, unless a developer comes forward, delivery of a large network is unlikely to be viable.

Sensitivity and risk
The table below summarises the key risks for the network options.

Scenario	Phase	Key risks
A&B	All	• Connection risk (existing or planned buildings not connecting) • Low linear heat density (associated with dispersed heat loads) • Availability of land for energy centres • Changes to planned developments • Unsuccessful engagement with developers • Increases in capital cost • Existing social housing not incorporating communal wet heating systems • Increased costs encountered when installing network due to groundwater and contaminated land issues • Low cost, low carbon heat from EGPS not being used (if a network is not developed)
Scenario A	1, 2 & 3	• Prohibitive heat offtake price • Accessing the tunnel beneath the Port canal • The network crossing physical barriers such as the railway line and A259 • Difficulty securing gas supplies for peak and reserve boilers if located on Port site
Scenario B	1a	• Changes to energy tariffs • Increases in capital cost • Securing private wire arrangements with private sector residential developments
	1b, 2, 3 & 4	• Biofuels CHP developer does not come forward • Prohibitive biofuel CHP heat offtake costs • The network crossing physical barriers such as the railway line and A259 • Difficulty securing gas supplies for peak and reserve boilers if located on Port site

For both scenarios A and B, the connection risks are significant due to a high number of connections including planned developments and private sector buildings. If priority heat loads do not connect, viability will be reduced. Reductions in heat demand of between 17% and 50% will reduce IRRs to below 5% and are likely to make the options unviable. The critical heat loads are Western Harbour Arm developments (stage 1), Adur Civic Centre redevelopment and King Alfred Development. The figure below showing a summary of key heat demands and their impact on the financial viability of

network options quantifies these key heat demands and their impact on the financial viability of the network phases. It clearly demonstrates that connection to the planned development at Western Harbour Arm (stage 1) is essential to provide the heat demand to initiate a heat network and the network options are unlikely to be viable if the Western Harbour Arm development does not come forward or connect. As these key heat demands are planned private sector developments there are very high associated connection risks. Successful engagement with the developers of these sites is critical to network viability.



Summary of priority heat demands and their impact on the financial viability of network options

If EGPS is developed without an associated heat network, the local authorities may receive criticism and reputational damage for failing to effectively facilitate a network coming forward if the potentially low carbon, low cost heat resource is perceived as being wasted.

If a detailed techno-economic feasibility study is to be progressed, significant further work will be required to engage with developers of planned priority heat loads, namely Western Harbour Arm developments (stage 1), Adur Civic Centre redevelopment, King Alfred Development, and existing priority heat loads, namely Shoreham Academy, Southlands Hospital and 79-81 Brighton Road.

Lower risk public sector heat networks have been assessed and are unviable due to the dispersed nature of the heat loads.

The 'preferred' network options outlined in Scenario A are reliant upon the development of EGPS and planned developments being brought forward. If EGPS, or another biofuel CHP scheme, is not developed there are very limited opportunities with borderline viability at best i.e. Phase 1a with gas CHP (with private wire arrangements) or Marine Source Heat Pump (if RHI is still available).

Summary of recommendations
The table below summarises the recommendations made in this report.

Recommendation	Indicative timeline[3]
Project strategy	
1. Consider the findings of this study to decide how best to support district energy developments.	*Immediate*
2. Receive updated technical, financial and project management information from EGP in order to inform the above decision.	
3. If EGPS is to be developed the project partners should enable and support the development of a network utilising heat from EGPS.	
4. Set clear objectives on what the network is attempting to achieve, linked to corporate priorities, and ensure senior management support by effectively communicating the project benefits.	*Short term*
5. Set up an internal project steering group and look to allocate resource to adequately support the feasibility process.	
6. Once the development plan for EGPS is confirmed, in consultation with EGP, the project partners should develop a clear timescale of decisions that must be met in order to align with EGP's development plan.	*Immediate and short term*
Resource	
7. Provide mechanisms and capacity to support network delivery at strategic and officer levels e.g. extend or create a new Project Board for project delivery and ensure officer capacity is available to support project delivery. Capacity should be made available by public sector project partners to work closely with developers and, if district heat projects are progressed, additional resource should be secured.	*Short term*
8. Discuss the viability of funding additional resource both internally and with support from DECC or the Your Energy Sussex Partnership; if the opportunity is deemed viable requirements of the role will need to be defined and a procurement route agreed.	*Short term*
Corporate (public sector partners)	
9. Facilitate engagement between key stakeholders, such as site businesses and developers.	*Short term*
10. Provide resource and financial assistance in delivering feasibility and design work.	*Short and medium term*
11. If EGPS is not developed the public sector partners may provide an enabling role to promote the EGPS site to other biofuel CHP developers.	
12. Encourage heat intensive businesses to locate in the vicinity of EGPS.	*Short, medium and long term*
13. Provide and/or secure land for construction of peak and reserve energy centres and pipe routes.	*Medium term*

[3]

Indicative timeline	Project stage
Immediate	Prior to feasibility
Short term	During feasibility
Medium term	During detailed project development
Long term	During project delivery

14. Commit to long term purchasing contracts with the network operator.	
15. Engage with and support planning consents and highways activities.	
Project development	
16. Undertake detailed consultation with all potential developers and, in particular, those seeking to bring forward Western Harbour Arm developments (stage 1), Adur Civic Centre redevelopment, King Alfred Development and identify business cases for planned developments to connect to the network (from the developer's perspective).	*Immediate and as developments are brought forward*
17. Develop an external stakeholder engagement plan to support the project development process.	*Short term*
18. Undertake further stakeholder engagement exercises including: discussions with key heat load clients to obtain historical energy data, technical details and to gauge enthusiasm for the project.	
19. Update heating / cooling demand and supply assessment to include: an updated energy demand and supply assessment for the prioritised areas; detailed consideration of the condition/asset survey currently being undertaken on behalf of Adur Homes; and site surveys to assess the financial cases for existing key heat loads to connect.	
20. A concept design should be developed for peak and reserve energy centre and plant to include a review of recommended energy centre location(s), relevant general arrangements, specifications and indicative sizing for all key plant and equipment items.	
21. A concept design should be developed for the heat network to include a detailed network analysis, optimisation and design for the priority network incorporating concept drawings, process flow diagrams and GIS representations.	
22. The project partners and/or representatives should liaise with potential end-users to seek assurances for heat offtake.	
23. Conduct detailed investigation of physical barriers, particularly in relation to crossing the railway line, crossing/disrupting main roads and contaminated land and groundwater issues.	
24. Develop a detailed financial model to determine all relevant financing options, scheme costs and income for the scheme taken forward; this should involve developing a detailed 25 year and 40 year life cycle, discounted cash flow model.	
25. Explore options for raising further financial support through grants, HNDU (for further feasibility work), Government district energy capital investment grants[4], European Regional Development Fund (ERDF), European Local Energy Assistance (ELENA) programme (for network development work), Your Energy Sussex, SALIX[5] and ECO (for connection and retrofit works to public sector buildings).	
26. Develop an implementation programme and phasing plan to include an investment timeline and delivery plan.	
Planning	
27. The JAAP, Adur Local Plan and B&H City Plan should be amended in line with the specific recommendations made in this report.	*Short term*
28. If EGPS is developed, it is recommended that the project partners set local requirements for decentralised energy which relate to the priority network identified in Scenario A.	
29. Planning authorities should require proposed developments to connect to a network where it exists, or for the development to be designed so that it can connect to a future network where a viable network is identified.	

[4] £300M announced at November spending review to bring forward 200 heat networks in England and Wales.
[5] Interest free loans for connection to existing district heating via plate HE and thermal stores.

30. District heating potential should be included in both the Adur and Brighton & Hove Infrastructure Delivery Plans and where CIL is being adopted, in the Regulation 123 Charging Schedule.	
31. Consideration should be given to the use of Section 106 Agreements to: collect contributions for heat network schemes; oblige developers to connect to planned networks, existing networks and networks under construction; set specific technical requirements to enable connection; and futureproof connections to planned networks.	
32. Consideration should be given to securing additional planning resources with which to support development of district heating schemes and engagement with developers.	
33. Safeguard energy centre locations and encourage heat intensive business to locate in the vicinity of EGPS.	*Short, medium and long term*

Planning recommendations

Planning policy and planning teams play a crucial role in the development of heat network projects. The technical and financial work undertaken will provide an evidence base for drafting planning policy to support developer negotiations, planning conditions, Section 106 Agreements and the Community Infrastructure Levy.

Project partners should set local requirements for decentralised energy which relate to the potentially viable network options and development areas identified in this report. This will include requiring proposed developments to connect to a network where it exists, or for the development to be designed so that it can connect to a future network where there is a planned or identified network.

The planning authorities in the Shoreham area should develop development management processes to require proposed developments to connect to a network (where it exists), or for the development to be designed to have capacity to connect to a future network (where it is planned or identified).

The planning authorities in the Shoreham area can require proposed developments to connect to a network (where it exists), or for the development to be designed so that a development can connect to a future network (where it is planned or identified).

Section 106 Agreements may be used to promote network development but have had limited application in a district heating context, and as such the strength of this mechanism in supporting heat network development is relatively untested. It is likely that the project partners will require additional technical and planning resource with which to support engagement with developers addressing district heating.

Next steps

The project partners should carefully consider the findings of this study to decide how best to support district energy developments in the Shoreham Harbour area. This decision will be heavily influenced by news on the progression of EGPS. Detailed further discussion is essential as the development plans for the power station project are critical to informing the next steps.