Ener-Vate Consultancy Limited

Energy Options Review for Bath Riverside

An Options Review of heat and power supply for Bath & North East Somerset Council

SMARTKLUB
Empowering Communities

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Contents

	Glossary
ASHP	Air Source Heat Pump
ESCo	Energy Services Company
LA	Local Authority
B&NES	Bath & North East Somerset Council
D&B	Design & Build
O&M	Operations and Maintenance
M&B	Metering & Billing
kWh	Kilowatt Hours
MWh	Megawatt Hours
GWh	Gigawatt Hours
NIA	Nett Internal Area
BESS	Battery Energy Storage System
HV	High Voltage
OPEX	Operating Expenditure
CAPEX	Capital Expenditure
REPEX	Replacement Expenditure
COP	Co-efficient Of Performance
IRR	Internal Rate of Return
NPV	Net Present Value
DNO	Distribution Network Operator
DUoS	Distribution Use of Service
iDNO	Independent Distribution Network Operator
PPA	Power Purchase Agreement

1 Introduction

1.1 The Project

1.1.1 Ener-Vate Consultancy Ltd and SmartKlub Ltd have undertaken a research project to examine the options for establishing an Energy Services Company (ESCo) at new developments in each of four Local Authority (LA) areas.

1.1.2 The LAs involved in the project are:

- Eastleigh Borough Council,
- Isle of Wight Council,
- Bath and North East Somerset Council, and
- Cornwall Council.

1.1.3 This report looks in more detail at the possibility of alternative approaches to:

- Providing low carbon heating and hot water to the forthcoming Riverside Enterprise Zone Developments for BANES.
- Finding a pathway to resolve the power constraints in the area.

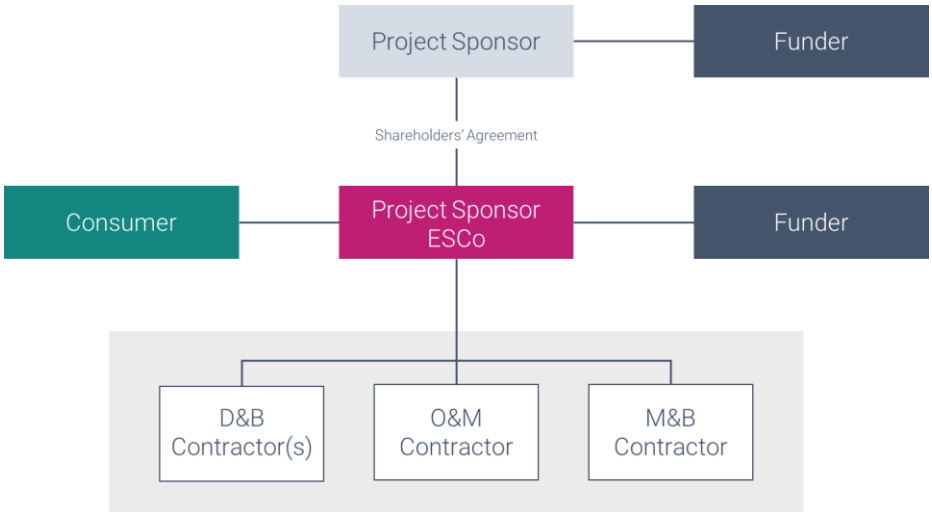
1.2 ESCo Commercial Structure

1.2.1 A business that sells an energy service adds value to the provision of energy as a commodity by meeting some additional aspect of the customer's needs.

1.2.2 In its most developed form, an ESCo provides a commitment to deliver the benefits of energy to a specified level of performance and reliability whilst providing the ESCo entity itself with long-term revenue streams.

1.2.3 This business model is of particular interest to LAs because an ESCo with a performance contract has a strong incentive to increase the energy efficiency with which it meets its contract, and thereby drive down carbon emissions.

1.2.4 Following the recent "Common Scope ESCo Report", published by Ener-Vate, the "Project Sponsor ESCo" has been selected as the structure that underpins this report as this provides the greatest control and maximum financial return for the council.



2 Project Sponsor ESCo

2.1 Roles and Responsibilities

2.1.1 The Project Sponsor establishes a wholly owned ESCo to deliver the low carbon energy scheme without a 3rd party.

2.1.2 The Project Sponsor will be the low carbon energy scheme asset owner and operator.

2.1.3 The Project Sponsor will be responsible for funding the low carbon energy scheme as well as the procurement of D&B, O&M and M&B contractors.

2.2 Control, Risk and Reward

2.2.1 The Project Sponsor will have control of the ESCo's contractors, future expansion and tariffs for the low carbon energy scheme therefore giving a lot of flexibility.

2.2.2 The Shareholders' Agreement will regulate the decision making in the ESCo, for example which decisions can be made by the ESCo itself, and which decisions can be made by the Project Sponsor as shareholder.

2.2.3 In return the Project Sponsor will take on all funding, construction and operation risk. It will also benefit from all the financial rewards from the success of the project.

2.3 Exit Strategies

2.3.1 The Project Sponsor could sell its shares in the ESCo or refinance any debt extended to the ESCo.

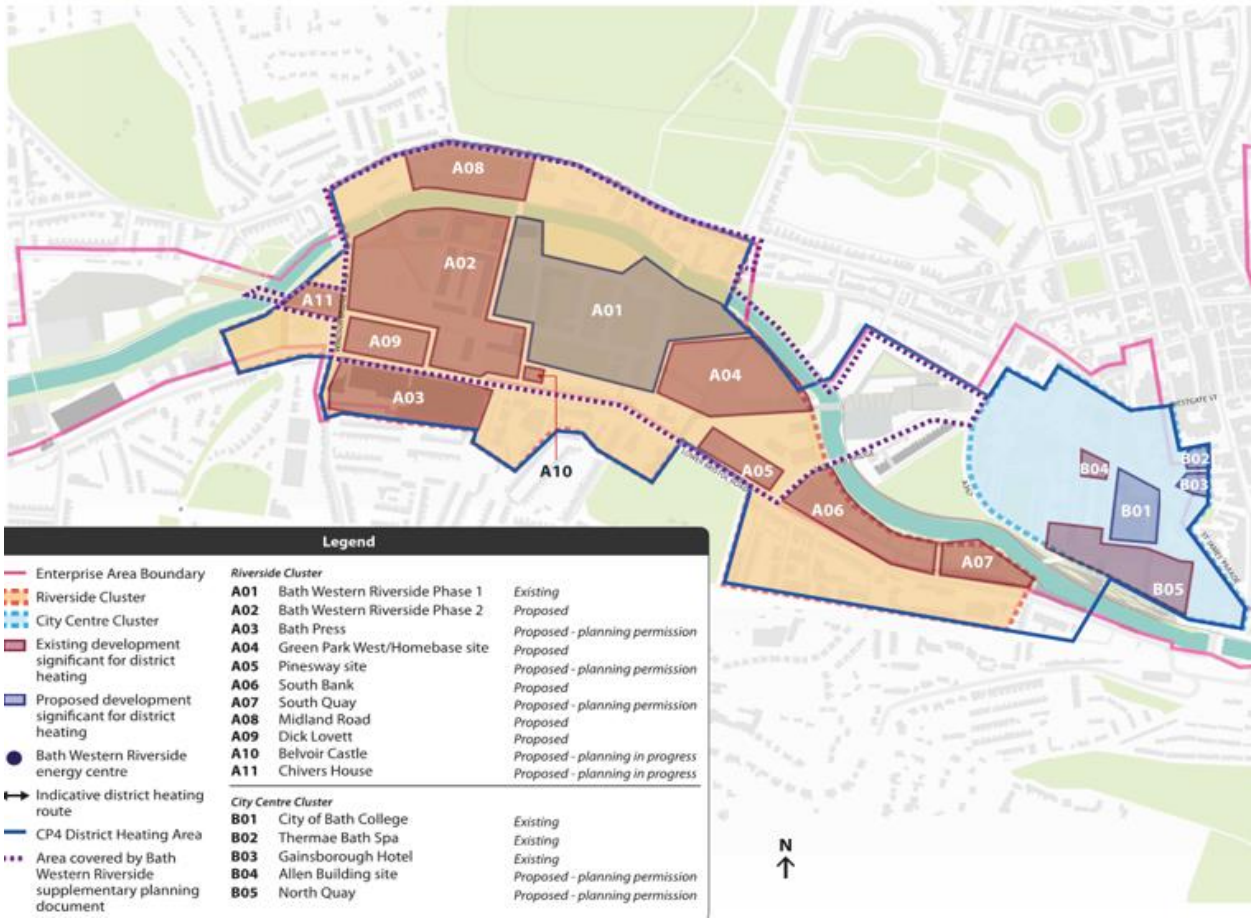
2.3.2 Should the Project Sponsor wish to sell its shares, the low carbon energy scheme should be fully built and operational over a period of a few years to be attractive to a secondary market.

2.4 Advantages and Disadvantages of a Project Sponsor ESCo

We recommend the Project Sponsor ESCo model as appropriate, due to its to deliver the needs of the development and achieve climate change targets. Once the ESCo is established and proven for a period, it could be sold, or part sold to reduce responsibilities and generate revenue. This could be part of a council strategy to 'pump prime' ESCos in the local authority, with a finite amount of capital that is refreshed each time a proven ESCo is sold on. This will make Bath more renewable, while limiting risk to the LA and showing leadership to the private sector.

Advantages	• Project Sponsor retains all strategic control over the project such as future expansion and setting power tariffs. • Opportunities to exit the project through the sale of shares and/or refinancing of project debt. • Maximises opportunities to use the clean solar energy from new solar farm to supply businesses and common infrastructure.
Disadvantages	• Project Sponsor is exposed to all project risks (if not passed down to contractors). • Responsibility for funding/securing funding lies with the Project Sponsor. • The Project Sponsor will need to procure external expertise and skills.

3 Masterplan



The Masterplan is well understood by B&NES and relevant stakeholders, this is simply to illustrate the region being discussed in this report.

4 Heat

4.1 Existing District Heating Infrastructure

4.1.1 Bath Riverside Phase 1 of c. 830 residential units is currently served by a District Heating system owned by Crest Nicholson Regeneration (CNR) and operated by E.ON UK Plc (E.ON) through an ESCo Concession Agreement.

This is a low carbon gas CHP/biomass boiler led system that complies with the Building Regulations and local planning conditions at the time of consent. While considering the approach for supplying heat to the forthcoming developments there is a question mark over whether the existing system or energy centre has a part to play.

E.ON holds a concession from CNR to operate the scheme until around 2034/35, at that point CNR will decide what to do with the system, they have options:

a) Re-let the concession back to E.ON

b) Let the concession to another energy provider

The system will have some value from the guaranteed long-term revenues so a commercial deal will need to be struck with CNR to take control of the assets at the end of the current concession.

4.1.2 Consideration has been given to the de-carbonisation of Phase 1; we recommend this is not approached in the short-term for the following reasons:

- E.ON will likely be unwilling to explore any option that doesn't include the existing CHP, which is an important source of revenue for their ESCo.
- The suite of agreements, deeds, leases and easements already in place between CNR & E.ON will take a lot of resource to unpick, with little appetite from E.ON or CNR to do so without any clear benefit for either.
- Riverside Phase 1 DH system and residential units have been designed with a primary flow temperature of 85 DEG C in winter (75 in summer), this is very difficult to de-carbonise through centralised heat pumps as their efficiencies to supply heat at these temperatures are very low.

The recommendation is to stay in touch with CNR & E.ON and work towards an outcome that is suitable for all at the end of the current concession term.

4.2 Current Approach for Riverside New Development

4.2.1 Currently B&NES are pursuing a scheme which would take low temperature (LT) heat from Wessex Water's sewage pumping station which is located next to the DH energy centre at Bath Riverside Phase 1.

The heat would then be raised in temperature by a heat pump to c. 65 DEG C then distributed to new developments through a heat network. Heat would then be transferred to connected properties via Heat Interface Units.

Building on previous work by Buro Happold there is an alternative that is worth exploring.

4.3 Alternative Approach

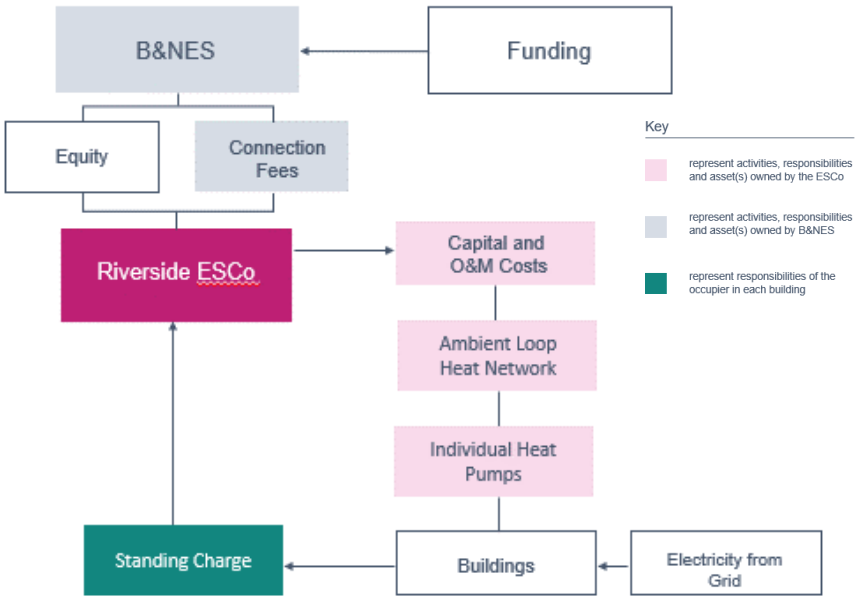
4.3.1 Another way to supply heating and hot water to the new residential developments whilst still using the heat from the sewage pumping station is via an Ambient Loop Heat Network and distributed Heat Pumps.

- Heat energy is extracted from the sewage system and transferred to district heating system via a Heat Exchanger.
- Ambient Heat is pumped around the DH Network to properties.
- Heat is raised to temperature (65 DEG C hot water and 50 DEG C Heating) via a heat pump in each building with a hot water cylinder.

In this scenario ESCo would supply, install, operate and maintain the Heat Network and individual Heat pumps. Residents would pay for the following:

- Electricity to power the Heat Pump from supplier as normal
- Standing charge for access to Heat Network
- Standing charge for Heat Pump maintenance & replacement

Ownership and financial flows for this type of structure are outlined below:



4.4 Outline Financials

4.4.1 ESCo Revenue

Residential Customers will pay an annual Service or Standing Charge split into two items:

Annual Service Charge	Residential
Connection to Network	£75
Heat Pump maintenance	£200
Total	**£275**

Developers will pay a connection fee that effectively pays for the low carbon energy system of £4,000 per unit which is inflated through the build-out period.

4.4.2 CAPEX

ITEM (uninflated)	£	Notes
Energy Centre	1,000,000	HEX, water treatment & pumping
Heat Network	3,000,000	Plastic distribution pipe
Heat Pumps & cylinders	7,280,000	3kW heat pump + 120L cylinder
Legals	100,000	
TOTAL	**11,380,000**	

4.4.3 OPEX

ITEM	£ lifetime (uninflated)
Energy Centre	777,500
Heat Network	188,250
Heat Pumps	6,009,875
Electricity	419,400
Metering & Billing	795,000
Bad debt	232,088
Water Use of System charge	600,000
Business rates	249,891
TOTAL	**9,272,004**

ITEM	£ annual at build out 2032 (uninflated)
Energy Centre	20,000
Heat Network	4,438
Heat Pumps	174,500
Electricity	8,360
Metering & Billing	23,100
Bad debt	4,561
Water Use of System charge	15,000
Business rates	5,922
TOTAL	255,881

4.4.4 REPEX

ITEM	£ lifetime
Heat Pumps & cylinders	3,600,000

4.4.5 SUMMARY

BASE MODEL ASSUMPTIONS & OUTPUTS (INFLATED)	
Residential properties	2,400
Discount Factor	3.50%
Concession Term	40 years
Connection Fee Income (total)	£11,828,265
Heat Standing Charge Income	£45,731,268
CAPEX	£15,262,109
OPEX	£18,221,583
REPEX	£6,831,002
IRR	8.50%
NPV	£3,738,196

4.4.6 Cost comparator for residents

Below is a comparator between Ambient Loop system and individual Air Source Heat Pumps per property:

ASHP

Elec Volume	1,800	kWh

Heat Volume	4,500	kWh

	Tariff p/kWh	Total Tariff	Total Standing Charge	Total Elec Cost	Annual Maintenance	Annual Repex Accrual	Total	Equivalent Heat Price Tariff
EDF	18.71	£336.78		£336.78	£210	£333.33	£880.11	£0.20
SSE	17.76	£319.68		£319.68	£210	£333.33	£863.01	£0.19
Scottish Power	18.71	£336.78		£336.78	£210	£333.33	£880.11	£0.20
							Ave.	**£0.19**

Ambient Loop Heat Network

Elec Volume	1,500	kWh

Heat Volume	4,500	kWh

	Tariff p/kWh	Total Tariff	ESCo Standing Charge	Total Cost	Annual Maintenance	Annual Repex Accrual	Total	Equivalent Heat Price Tariff
EDF	18.71	£280.65	£275	£555.65			£555.65	£0.12
SSE	17.76	£266.40	£275	£541.40			£541.40	£0.12
Scottish Power	18.71	£280.65	£275	£555.65			£555.65	£0.12
							Ave.	**£0.12**

Assumptions used	
ASHP capex	£4,000
ASHP life (yrs)	12
ASHP COP	3
Maintenance	£210
HP COP	3

4.5 Summary

4.5.1 There are many benefits to using this type of system:

- Lower capital and operational costs than a higher temperature network with a large, centralised energy centre.
- No gas involved so will naturally de-carbonise in line with the grid.
- Competitive for residents with no maintenance or replacement costs.

5 Power

5.1 Purpose

5.1.1 The purpose of this section is to scope potential ways that B&NES Council can overcome local energy generation issues associated with the Bath Riverside development area. This paper is a high-level document that B&NES can use to scope follow up, detailed work to turn the ideas into practical solutions as part of the development.

5.1.2 Introduction

Regarding the Riverside developments, it is clear that there are too many 'moving parts' to decide on a concrete scheme for SmartKlub and Ener-Vate to work on in the same way as for the other LA projects. B&NES believe they are already covered for the heat proposals, so the focus is on options for renewable power production within an ESCo.

5.2 Problems and their potential for solutions

5.2.1 After several conversations, the problems can be summarised as follows:

- Generation space - the Riverside is already well developed so most sites are brown field within historic constraints and high land prices. Space for solar PV is particularly lacking as new developments are predominantly apartment blocks with poor ratio of roof/wall mounted solar space to demand. Furthermore, land values being very high, it is uneconomic to devote land space to ground mounted arrays in or near enough the site to justify private wire. This problem is unsolvable. What roof space there is on the apartment blocks can be used for ESCo or communal services.

- Grid availability - without a proactive solution, prompted by the council, at some point in the near future one of the many prospective developers will hit the severe grid constraint in the area and so will suffer the cost of a new primary transformer costing c£5m (plus c£0.5m in lost opportunity on land value at £2m/acre). This will put off developers and possibly derail the council's development plans. This can be solved through council, developer and DNO co-operation.

5.2.2 Proposed Solutions

While in the short to medium term, the lack of potential green power is disappointing, in the long term this will be solved with the national grid's successful decarbonisation. The most rewarding actions, therefore, are to maximise renewable heat and resolve the grid access problem in an equitable way. These proposals achieve this we believe.

5.2.3 Grid Availability

It is possible for the council to purchase the primary in such a way that at least recoups its costs while potentially making a medium-term revenue stream, while not constraining the developers or ESCo designs in the new developments, and thus maximising the attractiveness for developers and communities alike.

As a primary is required, we have discounted an iDNO option as the proportion of contestable works are very low so as not to be material. WPD must be engaged and the sooner the better to avoid delays and even be part of their Ofgem approved DNO plan from 2023. The following approach is recommended:

- B&NES Council take the lead and procure the primary under an ESCo (that could be a JV in order to optimise funding match).
- Apply for and utilise available grants (e.g. ERDF 50/50 match) to reduce the cost and fund the balance through the Public Works Loans Board debt.
- Charge the developers a connection fee to pay off the debt and interest over the lifetime of the development plan for the initial 2,400 homes. The cost of the connection charge would be approximately £500 per home per £1m of debt. So even if no grant were forthcoming, the connection fee would be less than £3k per home. Given Bath's property prices, this is not an unreasonable amount. Furthermore, given the heat solution we are proposing, a good combination of upfront cost and lifetime value delivered, see Appendix A for a simple loan account model.
- We estimate that the primary not only delivers the 2,400 units in current plan, it also unlocks the potential for a further c5,000 homes on surrounding brownfield sites. The ESCo can use this as a source of long-term value from WPD, to recoup the expenditure of a primary via a simple mechanism.
- The first mover or instigator of the primary who has paid the full amount (the ESCo) is registered with the DNO so that any subsequent connection enquiries and connections from that primary will be charged by the DNO in the same way as they ordinarily would. However, the DNO then compensates the instigator with this value. This mechanism stays in place for 5-10 years depending on the DNO area, so capturing all future connections and recoup values for the ESCo's investment.

6 Sustainability

6.1.1 The above heat and power recommendations both contribute to B&NES Climate Emergency agenda in a number of ways:

- The heat solution recovers heat from the sewage that would otherwise contribute to warming the ambient air.
- By using an ambient loop approach, heat losses and construction materials are minimised compared to a high temperature heat main.
- As the grid decarbonises nationally, the heat solution becomes greener still. Full decarbonisation of the grid equals a zero carbon heating solution.
- However, reaching a fully decarbonised grid is not just a case of having more offshore wind piped down the wires. In fact the wires cannot handle this without flexibility (interruptible loads and storage) that a heat pump solution offers:
    - If B&NES were to encourage/mandate a fabric first construction approach with second stage heat pumps and thermal stores for the apartments, this would allow heat demand and production to be decoupled and so largely avoid running the heat pumps at peak times. This introduces flexibility into the low voltage grid.
    - In addition, if the ESCo owned and operated a Battery Energy Storage System (and some apartment roof solar PV) this could eliminate peak electricity demand for the heat pumps and so increase flexibility further.
- The new primary substation can contribute to decarbonisation targets too. In grid congested areas, WPD (or any DNO) have no current means of accommodating more heat pumps and electric vehicles as people in legacy housing transition from gas heating and petrol cars. The extra capability that a new primary offers, allows a strategic approach to be considered for both heat and transport:
    - EV recharging could be established to include lamp post chargers plus dedicated car parks with standard and fast chargers.
    - Depending on the grid and location topology, legacy neighbourhoods could transition wholesale to electric heat pumps

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7 Appendix A

Year		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Resi units		0	240	240	240	240	240	240	240	240	240	240
Inflation	RPI	1	1.03	1.06	1.09	1.12	1.15	1.18	1.21	1.24	1.27	1.3
Conn Fee Revenue	£2,650	per unit	£655,080	£674,160	£693,240	£712,320	£731,400	£750,480	£769,560	£788,640	£807,720	£826,800
PWLB repayment	2%	£5,500,000	£660,000	£660,000	£660,000	£660,000	£660,000	£660,000	£660,000	£660,000	£660,000	£660,000
Cash			£4,920	£9,240	£42,480	£94,800	£166,200	£256,680	£366,240	£494,880	£642,600	£809,400