energis consulting ltd

Severnside Energy Recovery Centre

Heat Networks Development Enabling Study

31 March 2016

1 INTRODUCTION

The Study partners (South Gloucestershire Council, Bristol City Council, West London Waste Authority (WLWA), and SUEZ Resource and Recovery UK Limited (formerly SITA UK Limited)) wish to attract anchor heat loads to the Severnside-Avonmouth Enterprise Area to provide a springboard for a wider heat network. Energis Consulting Limited was commissioned to identify what types of heat consuming businesses might be attracted to the area by the SITA SERC facility and how to attract them.

The process started by understanding the heat and power delivery capability of the SERC and performing a high level comparison with the requirements of different relatively energy intense business sectors. This then enabled a more detailed techno-commercial assessment to be made, before identifying the potential benefits to businesses and selecting which industry sectors to survey in more detail. This was then followed by a series of telephone interviews, initiated mostly via existing network contacts or industry associations. Industry associations were a good source of high level information, which could then be followed through, in the more promising cases, with interviews with individual companies.

The raw data gathered and a detailed analysis of that data is provided in Appendix 4 of this report.

An almost universally significant factor for the sectors surveyed was the “region” in which the investment was to be made. While it was not the highest scoring factor in the survey, it effectively acted as a gatekeeper (i.e. it was a “go-no go” point). Predominantly this is driven by the need for proximity to raw materials and customers (although other factors come into play too, as shall be discussed). Where there is a good regional fit for heat consuming business, it is a very good start. On the other side of the equation, where the regional fit is poor, it is almost enough on its own to prevent investment. It is therefore important to work to the regions strengths.

After “region” the emphasis on what is most important tends to vary depending on:

- the type of investor
- size of the investment and
- amount of energy required.

Using this information, it has been possible to:

- match the SERC energy delivery capabilities to the possible industry sectors energy requirements (section 4),
- eliminate those industry sectors not suited to the region (section 5.2 and Appendix 4, Figure 4),
- describe those sectors according to their additional specific requirements (low cost, 57/58 planning consent, good local infrastructure, carbon intensity etc). (section 5.3)

This should permit more targeted focus on specific sectors in future and serve to guide the marketing approach to be employed.

2 UNDERSTANDING THE SERC'S HEAT AND POWER DELIVERY CAPABILITIES AND LIMITATIONS

A significant benefit of the SERC is that it provides a potentially low cost source of heat and this feature is primarily derived from the CHP nature of the plant.

The unit cost of heat is significantly dependant on the grade of heat. Setting aside the type of fuel burned, the economic efficiency of any CHP plant is greatest when low grade heat is extracted and lowest when high grade heat is extracted (as a simple illustration, in the extreme if high grade heat was taken directly from the boiler, it would generate no power and so the plant would not be CHP, it would just be a boiler). The lowest cost heat the SERC will produce therefore is hot water. The SERC has the ability to deliver up to 4.15 MW of heat in this form. Once the transition is made to extracting steam from the steam turbine the cost of producing heat is directly proportional to the cost of the electricity as shown in Figure 1. As the steam passes through the turbine from left to right as shown in Figure 1a it expands and its pressure reduces (as it gives up energy to drive the turbine shaft). The pressure of steam bled off from the turbine will depend on the location of the bleed. The overall CHP efficiency increases (more electrical power is developed) for bleed points further to the right. These differences are reflected by the slopes of the graphs shown in figure 1b. The slopes are the so-called z-factors (MW of steam extracted divided by the MW of reduced electricity generation). The steeper the slope, the higher the Z factor and the lower the number of MW of lost electricity generation per MW of heat bled from the turbine.

Fig 1a. CHP Configuration

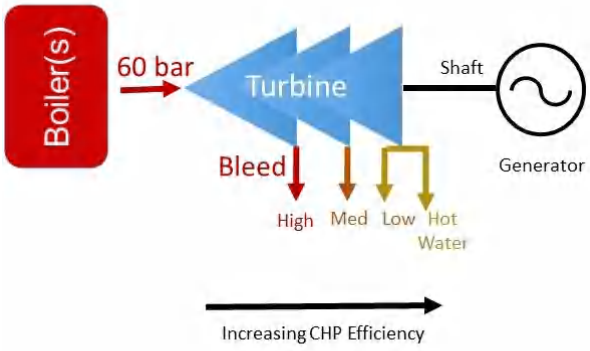
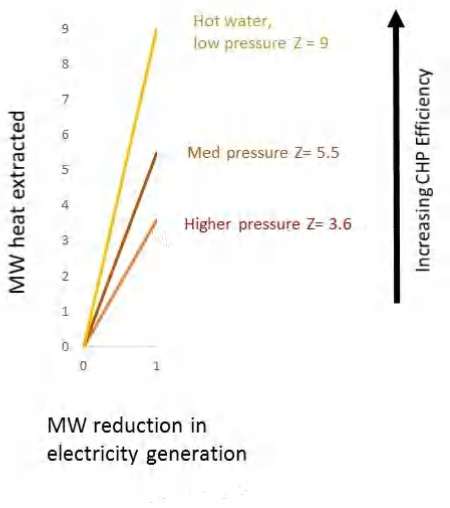


Fig 1b. How efficiency depends on steam offtake conditions



For baseload power plant (e.g. EfW , biomass or contracted CCGT plant) it is common to price steam extraction based on the marginal value of the lost electricity generation. Therefore, if the power sale price was £42 /MWh_e and the z-factor was 6, the steam would cost £7/ MWh_h, which is much cheaper than gas. If a subsidy, such as the RHI, is received for the heat, this would lower the cost even further[1].

For non-baseload plant, the pricing gets more complicated because it is not just a case of replacing the value of lost generation as the plant may not be economic to run all of the time. This leads to more complicated equations where the cost of the heat would be determined by both fuel and power prices and potentially the cost of running plant in standby mode ready to meet sudden peaks in demand. We can see that in the case of an energy from waste CHP plant the cost of the steam is not dependent in any way on a fuel cost – it is dependent only on the value of the lost electricity generation.

Fortunately the SERC also falls into the category of a 'must run' plant. Not only is it not exposed to fuel costs which may cause most fuelled generators to seek economic outages, it has to run to meet its waste diversion targets. It is therefore unlikely to incur stand by costs or suffer from turn down effects/ costs (for example, such as those which can be experienced with low summer space heating demands).

However, there are two types of turbine steam extraction:

> By far the simplest and cheapest is an **uncontrolled extraction** (so called "bleed") which is just effectively a flange on the turbine. The downside of this is that the amount of steam that can be extracted is limited (typically to around 15% of the steam flow at that point in the turbine) and more importantly the pressure is not controlled, so just floats with the load on the boiler. This can mean that steam is not available at the right pressure if one of the boilers is offline or at low load. In addition, the steam pressure from the boiler can vary over time according with the calorific value of the waste.
>
> The second type is a **controlled extraction**. This method enables extraction of much higher volumes of steam from the turbine in a manner where the pressure is controlled. To obtain controlled extraction, a throttle valve is installed within the turbine to maintain the correct pressure by restricting the flow of steam downstream of the extraction point. Typically each controlled extraction would add around £300-£500k to the cost of the turbine and in addition it is often the case that the "throttle" valve reduces the "power only" performance of the turbine.

We have read the WSP | Parsons Brinckerhoff reports and the SERC technical reports provided. The **SERC** is being constructed to be "CHP ready" and is designed to have **uncontrolled extraction**. This is normal and is to be expected in this situation. In order for the plant to have had full controlled extraction capability the precise details of the customers' heat specifications would have been needed at the design stage of the turbine (in order to know at exactly what points in the turbine to put the extraction points). The turbine designer could not have gone ahead and

[1] The public Capacity Market Register shows that the SERC has obtained a 15 Capacity Market contract. The rules will therefore preclude the SERC from obtaining RHI payments

'guessed' some heat characteristics, because if they were not exactly correct the eventual configuration would still not be optimised. Much worse, the ability of the plant to generate electricity in the scenario where there is no heat offtake (the current position and most likely the plant's economic base case), would have been significantly restricted for its lifetime (by the throttles of the extraction ports).

This means that the SERC will able to provide:

- 4.15 MW of hot water at 90°C.
- 5.75 MW of steam at 4 Barg (assuming both boilers online @ >85% load)
- 11.1 MW of steam at 9 Barg (assuming both boilers online @ > 85% load)

For the time being, we will assume the boilers will operate at around 90% availability (and that there is sufficient waste to run each line at 85% load) then the steam capability would be available for around 7000 hours per annum with steam needing to be supplied by a backup boiler for around 1760 hours per annum (such boilers requiring less than an acre of land).

Offtake of greater amounts of heat would be practical if the turbine was replaced. This would incur a significant capex and would incur downtime. Therefore if this were ever to be justified it would require a very large heat load and it would probably need to occur during a planned major outage SERC.

We have made enquiries to the SERC SPV to determine if its funding structure imposes any limitations on the ability of the SERC to deliver heat and power. The Lenders.. Redacted

3 UNDERSTANDING THE ADDITIONAL BENEFITS OF THE SERC AND ENTERPRISE AREA

From experience we believe the main potential benefits of the SERC and the Enterprise Area to be the following:

Lower Cost of Heat/Cooling

We saw in the previous section an example cost of heat (not including the potential RHI benefit) of around £7/MWh based on a power price of £42/MWh. Gas and power prices have a history of tracking other to some degree, so purely as an example and based on the typical spread between the two, we might expect gas prices to be around £14 /MWh, which would imply an alternative cost of heat from boilers of around £16 /MWh (after accounting for EU ETS carbon costs). This is a substantial advantage, but one which the off-taker would wish to share.

Lower Cost of Power (Embedded Benefits):

If a private wire were to be installed to supply local businesses with electricity directly from the SERC then those electricity supplies would also have a very low carbon footprint. There are also very substantial cost savings to be made. These are not associated with the CHP/EfW nature of the SERC generation, but rather from the

private and local nature of the electricity supplies. A separate and confidential briefing will be provided to the Study Partners on this (on 14/3/16).

The 57/58 planning consent:

The 57/58 planning consent is an old planning consent which is still in place allowing various forms of development. While not unique, the 57/58 planning consent is rare and it should be a significant advantage. It could significantly lower the barriers to inward investment and speed up the process. It can also act as an 'eye catcher'.

Lower capital investment: A business seeking to invest in a facility in the Enterprise Area will already have a significant a substantial funding requirement. The business may also have strong internal competition for funds. Connection to a heat network can lower the development/construction costs and the amount of capital required.

Environmental Benefit: The greater efficiency of CHP over the alternative, of separately generating heat and power in different plants, of course reduces carbon emissions. However the nature of the fuel used by the SERC means that the carbon footprint is extremely low. Energy recovery from waste is exempt from the EU carbon emissions trading scheme, so even without the efficiency of CHP the carbon footprint of the heat is essentially just the small residual associated with the logistics (and arguably this is offset by CHP efficiency). Recent government policy decisions have reduced the financial inventive slightly via the removal of the Consumers' Carbon Reduction Commitment and the abolition of LECs (removing the potential for CCL exempt electricity supplies).

Reputational Benefit: The double benefit of the nature of the fuel and CHP provides corporate investors with a very strong "sustainability" message on which to build image and reputation. In some cases this may be just a marketing tool which helps to improve brand image. In other cases it may be an essential requirement demanded by their customers. If anchor customers do indeed provide the key to unlock the door to the development of a wider distribution network in the area, there may be local enhancement of reputation also. A further reputational benefit may be association with diversion from landfill (perhaps relevant to the packaging industries).

Security of Supply: a larger scheme can justify dedicated operational and management resource including for the largest schemes on-site energy specialists which would otherwise be unaffordable. Backup supplies can also be more robust on a shared basis. Some industries (e.g. chemical and other process industries) may have critical security of supply requirements (no interruptions at all or at most for minutes). The implication of this is that the heat source must be backed up, sometimes with more than the usual 100% redundancy. Other processes may be able to with-stand short interruptions but only with some inconvenience and cost on their part (e.g. brewing, distillery, dairy) and some may not even notice for an hour or so (such as space heating) – although all are still likely to require backup, however reliable the SERC's performance.

Economies of Scale: As evidenced by the need for an anchor load there is a need for scale in the demand. Likewise, scale in the generation of heat & power lowers

costs below those of a number of smaller consumers building their own mini CHP's. The benefits of scale extend to shared back up also and, the larger the scheme becomes, the more robust this is likely to be. (The benefits of economies of scale are manifest via lower cost and better security of supply, so in the subsequent analysis this is not discussed as a specific feature.)

Space/land Saving: no need for companies to have their own boiler-house (assuming backup is provided at the network level, rather than individually).

Resource/Expertise: if the heat supplier/ESCO can provide a fully developed offering there is less for the investor to worry about. This can be a significant attraction to start-up companies. This extends to the operational phase as well, since the O&M burden of operating a boiler is removed.

Lower risk: similar to the previous point, this is one less risk for the inward investor to worry about and allows them to focus on the core business.

Future Proofing: a well-managed heat network provides the opportunity for multiple heat sources. As time passes, heat generating units may be replaced or additions made. This provides the opportunity for the consumer to benefit from technological upgrades or to switch fuels in a seamless fashion.

Access to Better Technologies: It may be possible for modest sized consumers to access technologies they otherwise could not. For example, it would be unlikely for a 1 or 2 MW heat consumer to otherwise be able to benefit from low carbon/low cost heat from an EfW

4 ASSESSMENT OF POTENTIAL BUSINESS TYPES

Appendix 1 provides a list of the large consuming industries. A red, amber, green traffic light system was used to categorise these. Steel, cement, glass and ceramic industries all require heat at higher temperatures than the SERC can deliver and so have been marked in red to indicate their unsuitability. Refinery, bioethanol, cardboard and LNG terminals are too large and would be able to consume more than the entire energy output of the SERC. The sugar industry is mature and new build is unlikely. These industries have not been marked as red, because if the turbine were changed it would be possible for the SERC to supply them with a baseload quantity to be topped up by other means

Appendix 2 provides the details of how the calculations are performed. An electronic copy of the spreadsheet is also provided. Table 1 is an extract from this:

Table 1 Extract for Spreadsheet Showing Results of Cost Comparisons

Process	Typical Heat Demand			Power	Assumed counterfactua	Viability Anal	
	MWh	Typical Conditions	Z factor	MW		Distance for payback on power &	Distance for payback on heat
Speciality paper / tissue	15	Steam @10barg,215deg(	3.6	3	gas CHP & gas boiler	3298	1909
Speciality Chems	15	Steam @10barg,215deg(	3.6	3	gas CHP & gas boiler	3298	1909
Food / brewing / dairy / dr	10	Steam@10barg,215degC	3.6	3	gas CHP & gas boiler	2717	1005
Pharma	8	Steam @10barg,215deg(	3.6	3	gas CHP & gas boiler	2447	528
Wood panel / building pro	8	Steam @5barg,160degC	5.5	3	biomass heat, grid pow	3541	1319
Large General Manufacturi	8	Steam @10barg,215deg(	3.6	3	gas boiler , grid power	6155	2810
Rendering / Waste process	8	Steam @5barg,160degC	5.5	3	gas / tallow boiler , gric	4628	2419
Malting (large scale)	5	Steam @5barg,160degC	5.5	2	direct gas / gas boiler ,	3784	1912
Animal feed	5	Steam @3barg,135degC	6	2	gas boiler , grid power	3538	1819
Large Glasshouse	5	hot water @ 60degC	9	2	gas CHP & gas boiler	3411	1477
Cold storage	equiv 13.5	chilled water	9	4	electric chiller plant (C	9327	6995
Data centres	equiv 9	chilled water	9	4	electric chiller plant (C	8480	4240

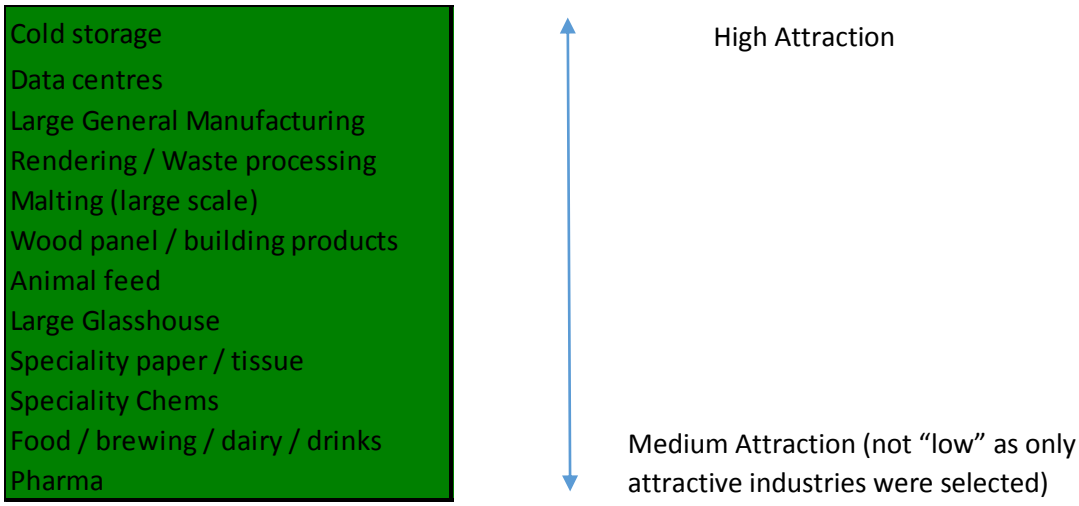
As a measure of viability, the table shows the distance the heat/power could be distributed for a 7 year payback versus the counterfactual cases[2] - the investors' most probable alternate solutions. (This could be presented differently if desired, for example by fixing the distance and calculating the payback period).

From the results we of course see a trend that lower grade heat offtakers have better economics (the project could afford longer distribution distances). Over-laid on top of this is the effect of the counterfactual solution. For example, cold storage and large glasshouses both have Z=9, but large glass houses have other attractive options, so cold storage appears comparatively better.

Sorted into order, the ranking is shown in Table 2, overleaf:

[2] These are the assumed energy sources with which the SERC is competing elsewhere in the UK. Of course, in a wider sense the competition may be tougher than this if one of the alternatives of the investor is to expand existing facilities or if the competition has some other advantage (e.g. shale gas in the USA). Details of these assumed alternative energy source are provided in the third paragraph of Appendix 2.

Table 2 Ranking of Sectors Based on the SERC's Technical Capability



This is the order of the suitability of the SERC to supply the customers based purely on their energy needs, it is not necessarily the order of attractiveness of the customers. For that, the match to the investors' other requirements have to be considered.

5 EVIDENCE GATHERED REGARDING INWARD INVESTORS' REQUIREMENTS

The survey work began by networking via existing contacts and by contacting industry associations (to both gather their views and to obtain further contacts). Appendix 3 contains a list of all the companies/bodies contacted and in total approximately 26 discussions were conducted, the majority being formal interviews, but some preferred to have just a more general conversation.

5.1 Overview of the Survey Process

In addition to interviewing respondents about their companies and sectors investment criteria more generally, they were also asked to provide a score out of ten regarding the importance to them of a number of criteria, listed below. These are based on the perceived advantages for the SERC/Enterprise Area (in order to prove or disprove their relevance), plus questions on the importance of the choice of region, local logistics/infrastructure, skills and suitability of the site.

1 Cheap heat and power (or cooling),
2 Reducing the capex of their investment,
3 Environmental benefits (low CO2, sustainability, reputation, customer demands),
4 Planning consent

5 Region,
6 Local logistics infrastructure
7 Skillset of the local workforce,
8 Suitability of site: access, flood risk, ecology etc,
9 Security of supply (of heat),
10 Benefits of a packaged offer for land and utilities,
11 Space saving (no need to have own boiler house),
12 Ability to focus management time on core business (rather than running boilers etc) and
13 Long term future proof nature of the supply.

The raw scores are shown in Appendix 4 Figure 1, but these are difficult to interpret. Therefore the average scores are shown in Appendix 4 Figure 2. In order to make the data easier to understand, we need to start eliminating some data. As we go through the following information, it would be borne in mind the scoring and data in Appendix 4 is only part of the story. More revealing are the comments respondents made and the explanations of why they hold certain views.

As mentioned in the introduction, the first choice investors make is which region to look at. It does not have the highest single score, but because they appear to make this decision early, it is extremely important. Investors with existing operations will usually look to expand at or near their existing operations first. Expanding an existing facility brings the obvious benefits of economies of scale, existing sources of supply, access to customers, minimal workforce disruption, minimal management effort, access to skills and local infrastructure etc. If that is not possible, they will still tend to remain in the same region, or relocate to a region where their industry is already established. The major determinants for sectors with a strong regional preference appear to be the need for proximity to either raw materials or to customers or to national infrastructure. New investors within the UK and overseas investors are also driven by these factors. Overseas investors in particular may seek to visit facilities similar to their own in the region to gain comfort that the supply chain is sufficiently robust (and they seem to see this as a benefit rather than a threat of competition). Infrastructure is also of some relevance here, discussed later.

Secondary to supply chain & access to market concerns, are issues such as ease of travel (an inward investment team needs to visit at an early stage and this will continue as management travels to and from 'head office'), is it a nice place to live, are the schools good (senior management involved in making locational decisions may be expected to move there) and are the universities good? The Bristol/ S Gloucestershire area is strong in all of these secondary areas

5.2 Detailed Analysis (by benefit)

A high score for "Region" in Appendix 4, Figure 1 indicates that the region in which the investment is made is important. If the score is high and the Bristol/S Gloucestershire region is a good fit, then the investment case starts to look strong, but if the score is high and the region is a poor fit, it becomes grounds to almost **rule out those industries from the outset, as follows:**

Panel Board Manufacture and **Paper** need to be close to standing timber and there is just not sufficient standing timber nearby for a new facility to be built in the Enterprise Area. Most facilities are built close to forests (often in quite remote locations) with the products being transported, rather than the more bulky raw materials. Furthermore, for these sectors the counterfactual heat sources can be relatively cheap, as their supply chain lends itself to readily integrate biomass boilers, sometimes to dispose of residues.

The **Malting industry** can probably also be discounted for similar reasons. Malting all tends to be in the east of the country where the barley is grown (due to the drier weather and more suitable soil conditions). Barley is not grown in significant quantities in the south west. The Redacted encouragingly said that if it was not for that, Redacted "would be ripping our arms off". Notwithstanding the poor location, Redacted invited us to speak to a gathering of Redacted. This is a good opportunity which should be taken up whenever offered (once the proposition has been fully prepared and the resources to field enquires established).

Poultry is another sector which can be eliminated. The poultry industry is a fully integrated supply chain, which means the slaughterhouses are co-owned and sit alongside the farms. The more energy intensive part of the supply chain is slaughterhouses. There are slaughterhouses all over England, although there is a concentration in the east. While there are some in the Welsh borders and Somerset there are none near Bristol/S Gloucestershire and there are no farms near there either. For that reason, according to the Redacted, "no-one would ever build a poultry slaughterhouse in the Bristol area".

Removing those sectors starts to make the data a little easier to understand. This can be seen in Appendix 4 Figures 3 & 4. Figure 4 shows only the remaining sectors suited to the Bristol/S Gloucestershire area. Examining Figure 4, in descending order of importance to investors we have:

Security of supply, logistics infrastructure and heat/cooling/power cost are now the biggest factors. Fortunately, the SERC and Enterprise area appear to be very attractive with respect to these three important factors.

Next comes the workforce skills, planning consent (for which the Enterprise Area is perfect with the 57/58 consent) and long term nature of the investment (for which the SERC is perfect with its very long term waste contract).

After that comes suitability of the site, environmental, reduced capex, a packaged offering and ability to focus on core. Space saving appears to be of little relevance.

The exact sequence is probably not that important and hiding behind the answers are one or two diverging views (which have been 'averaged' and so cancel each other out in the overall scoring and this is dealt with later). A great deal more is revealed by the comments respondents made during the discussions.

Looking at these factors (and referring to Figure 4 of Appendix 4 throughout) in more detail:

Security of Supply

Respondents appears to almost instinctively say that security of supply is critical, even probably when it is not. This therefore required some digging in the conversation at which point it would become clear that some industries (particularly those requiring low grade heat and cooling) do not require absolute security - for example space heat and cooling has an inertia which means loss of supply is not going to be noticed for at least tens of minutes and probably much longer (where as for continuous chemical processes the steam pipe may be emptied of inventory within a minute or two). However, it is the perception of the customer which matters and in any event the SERC cannot guarantee to run all year, so backup is required. The SERC is a “must run” plant, as its primary function is the processing of the waste, and it is designed to have minimum down time. This “must run” feature means that it does not take economic outages, unlike most other thermal electricity generators.

In summary, Security of Supply is an important factor and the SERC is more reliable than most generators, but for most customers, anywhere, heat backup will be required.

Logistics/Infrastructure

Logistics and infrastructure is related to the choice of ‘region’. Industries do tend to cluster for reasons of access to market and raw materials/support services, but also because they can share infrastructure. The companies interviewed generally saw the Enterprise Area in a favourable light with reasonable rail passenger access and good motorway access. They were specifically asked about the issue of the approx. 5 to 6 miles distance to the motorway junction and they almost all said it was not an issue. Many went on to say they have facilities in much more remote locations than this (for reasons of access to raw materials, such as sawmills located in forests or dairies in milk fields etc). A few respondents turned back to the issue of road access when discussing the details of the site and that is a flood risk zone 3 (flood plain data not accounting for the flood defences)- they said that the important factor is not so much the distance to the motorway, but that the local roads at all times remain passable (not blocked by flooding or snow and even bridge collapse was mentioned). It is noted that a flood protection study has just been commissioned to investigate the current levels of flood defence and to design a new flood protection scheme and this should be of benefit in this regard.

Focussing more closely on the infrastructure at the site itself, important issues are: a made up site road, the availability of the electricity connection (from the SERC in this case) and other utilities (e.g. effluent disposal). These are in fact issues of cost reduction and where a site is strong in this regard, can be used to counter rival sites where there may be a grant but there is poorer infrastructure. Good existing infrastructure also allows the development to occur more quickly and enables to potential investors to imagine their plant being built in that location.

In summary, Logistics/Infrastructure is an important factor and is one where the SERC/Enterprise Area is reasonable strong (provided the local roads always remain passable).

Cost of Heat, Cooling (and Power)

Unsurprisingly, concerns about cost vary strongly depending on the amount of energy used. For some respondents energy costs are relatively low Redacted said 1.5% of turnover) and for others it is very high (Redacted said 35-40% of production cost). This tends to reduce the average score, when actually those who score this factor highly are those most attractive to the Study Partners. It was clear in conversations that cost is the dominant factor (after region) in the minds of those with high energy demand. In other words, it matters very much to the types of company which matter most to the Study Partners and it will be key factor in investors' decision making process. It is therefore important that the potential low cost is highlighted from the very outset and its profile maintained and delivered upon throughout the inward investment process. (It is also important this this is pitched at the right level and after due consideration by the SERC in particular - so as not to create false expectations). At the end of the day, for big companies, the decision making process will convert almost all of the factors discussed into this paper into financial terms and so a direct low cost input into their economic model will be a major factor in that model. It could go a long way to countering grants and other financially quantifiable factors elsewhere and ultimately beat the competition.

For the reasons given Section 2 and the first part of Section 3, the SERC is extremely strong on price. There will be better propositions (for example plants consuming their own waste), but not many. The "must run" nature of the plant also means costs, for nearby heat customers with peaky demands, are kept low as there is no need to run inefficiently keeping boilers ticking over during periods of low demand (e.g. domestic hot water supply in summer).

Skillset of the Local Workforce

Most respondents said it was important, but the average was pulled down a little by some low skilled jobs in the food sector. In some sectors there is a trend toward automation, which is increasing the level of skills required. The Bristol/S Gloucestershire area was seen to be reasonably strong in this area (as a result of the aerospace industry).

57/58 Planning Consent

Like the cost of energy, planning consent matters most to the companies which matter most. This was evident in the diversity of responses to questions, but a few respondents also made the following comment: Companies likely to bring large numbers of employees (and probably with lower energy costs in proportion to their turnover) are more likely to assume they will get planning consent wherever they go (provided it is appropriately zoned). Developers of larger facilities (e.g. chemicals manufacture, diary, meat renderers etc) are the ones which say they tend to find planning consent more difficult to obtain – and these are the companies which tend to use more energy. Dairy UK commented for example that dairies "tend to stand

tall on the landscape". As an added benefit, the area may well be accustomed to the chemical industry and other 'big' industry as a result of the former ICI works, Seabank power Station and now the SERC. Redacted

In summary, the 57/58 planning consent matters to the biggest users, but not to smaller ones such as those requiring space heating, chilled food production & distribution, data centres etc where it is more of a nice to have.

Long Term Nature of Supply/ Ability to Future Proof

The SERC has an approx. 30 year life and this is attractive to investors. Any company which consumes significant amounts of energy is likely to require significant capital expenditure requiring depreciation over a long period, and this was borne out in the interviews. The long term nature of the SERC and the good reputation of SITA go a long way to attracting long term investments. The nature of the EfW supply is seen as being up to date, but the ability to connect to other heat sources at some point in the future via a network is a benefit and lowers risk further for investors.

Suitability of the Site

This was a tricky subject for people to pin down. They felt that a suitable site was of course necessary, but that they would assume from the outset it was of sufficient size, level and that access roads already built would be an advantage (dealt with under Infrastructure). The degree of preparation of the site was generally viewed as being an issue relating to capital investment (i.e. if the site which was already prepared it would save them money). One respondent showed aerial photographs showing of a site (land previously reclaimed from the sea) before and after preparation. In that case the development agency had prepared the land (scraped, raised and levelled it) to make it look like a development site. This may not be required for the Enterprise Area where, green field looks attractive.

A dairy company commented that it is important to their customers when they visit that it looks like a food factory and that the surroundings are appropriate to that. The Enterprise Area would probably be acceptable in that regard, and that specific company already has a modern waste plant immediately adjacent to one of its diaries without any known issues.

Unfortunately data centres require better than 1 in 1000 year flood risk (zone 1). This is considered essential, except they will consider areas with flood defences (the example given was the Thames barrier). The Enterprise Area is marked on the EA maps as benefitting from flood defences, so it should be checked whether those are adequate (unlikely based on the Amion report), because otherwise data centres may be a very good match.

In summary, most respondents seemed to think if the site was suitable for the SERC then it would be suitable for them, but the flood zone 3 issue needs managing up front and a positive story needs to be developed. Fortunately, it is not the highest priority on the agenda, but the flood risk could rule out more sensitive investors.

Environmental Benefits

This appeared to be of lower concern than expected, especially for the higher energy consumers, who tended to regard it as more of a cost issue (and carbon is currently cheap). This is because these larger consumers tend to produce in bulk and are well removed from consumers. Most however do say they can see it coming, but it is not currently such a high priority. One respondent put it eloquently, "it's coming up the supply chain". Those closer to consumers had a greater concern, but it is quite a long way down the agenda of most of the larger energy consuming customers.

A couple of respondents commented that they would expect low carbon energy to cost more. If it was in strong demand, this would be a significant opportunity for the SERC, but since it doesn't appear to be, anyone marketing the low carbon benefit will need to be careful to not be unintentionally off-putting.

For these reasons, the concept of a "low carbon energy park" may still be a little ahead of its time.

An exception to this pattern is bioethanol refining. Low carbon energy supplies are vital to this process. The bioethanol is made from grain and blended up to 5% into petrol to lower CO2 emissions. The refining process is very similar to that of a distillery and it requires significant amounts of heat and power (a large plant could use several times the output of the SERC). If that input energy is not low carbon, the bioethanol would no longer qualify as low carbon and would be of very low value. Unfortunately there is a problem with the bioethanol market at the moment and the relatively newly built plant of the respondent is taking a prolonged economic shutdown. Most likely the UK will need to move to 10% ethanol in petrol for normal production to resume. If any more bioethanol plants are built in future, they are more likely to be of a new generation, not competing with food production for resource, by using something like algae instead. This would require heat, but sounds some way off.

Reduced Capex

Some investors viewed the ability to avoid capex on boilers etc as simply a (positive) price issue, to be taken in the round over the life of the plant. Others, with greater need for security of supply felt backup boilers would be needed anyway, although presumably not as many.

Ability to Focus Management Time on Core Activities was also not a big factor. That is because if energy costs are important to a company it is worth their while getting involved and developing their own expertise. However this has an important consequence for the study partners, as they need to be able to match that expertise throughout the enquiry and subsequent project development phases. It tended to be of some benefit to more modest size energy consumers with less in-house expertise.

A Packaged Offering was also not high on the priority list, for similar reasons – if energy is important enough, or the project (i.e. investment) is very large, it is worth their while putting in the effort to do due diligence themselves. Some did describe it as a nice to have and said that 'checking' was easier than having to do the work from

scratch. This feature should not be dismissed however, because without it, it would be harder to catch the potential investor's attention in the first place.

Space Saving

Space Saving does not appear to be important investors. That is because if they are building a new facility, they assume there will be plenty of land available and because, if security of supply is important to them, they will have to build backup boilers anyway. Some respondents said that space saving was relevant on their existing sites, which can be old and cramped, but that would not be sufficient incentive to relocate.

Conclusions on the Factors Important to Investors

The factors discussed were confirmed to be important to inward investors, with the exception of "space saving". Issues such as local infrastructure and security of supply are universally important. For the larger energy consumers, cost and the 57/58 planning consent are important, but for more modest size consumers less so. Relatively few industries seem to have a strong current requirement for low carbon energy (although they say they can see it coming). Those most interested in low carbon supplies are those closest to the consumer end of the supply chain, especially those with high added value, which tends to be the more modest size energy users. The distance to the motorway junction does not appear to be an issue, so long as the roads remain passable at all times.

5.3 Detailed Analysis (by industry sector)

Food/brewing/diary/drinks/cold storage

This sector seems suitable to the Enterprise area. It seems to pass the 'regional' test and these industries require significant quantities of heat.

The dairy industry seems to be particularly well suited. Respondents commented that the industry is at the bottom of the cycle, but there still seem to be opportunities. The major UK operators are Muller, Arla, Lactcalis and Glanbia (Dairy Crest have sold a number their business). The thinking is now that in order to competitive, a plant needs to be very large, which means 1 billion litres of milk pa or 50,000 tonnes pa of cheese.

On the continent there has been large scale investment in powder plants, but the UK remains dominated by milk. It may be possible to attract those companies, or the Americans, to invest in a powder plant here, for the export market via the port.

The Enterprise Area is in an extremely good location for dairy. It is suitable for the milk fields of Wales, Cornwall, Devon, Somerset and via the M5/6 from Cheshire too. It is also well suited to send product to London, the SE, Birmingham and the NW.

The thinking at the moment is to locate manufacture of 'products' (e.g. cheese) near the milk fields, then as the water is removed to make the products, transport costs are lower. However for milk this advantage does not exist so it is better for the dairy to be closer to the conurbations as it maintains the freshness (Redacted said 2/3^{rds} of

the way from the milk fields, 1/3rd from the consumer). The Enterprise Area has good motorway links to markets in London, the SE and the Midlands. Dairy also would benefit from the 57/58 planning consent (difficult to get in rural locations and the plants are prominent on the landscape) and they use significant amounts of the right grades of steam (10 barg down) and hot water. Effluent disposal is a requirement, so it should be investigated with Wessex Water what is available. Redacted commented that the port facilities offer the potential for inward investment (particularly from China and the USA) to establish production for export of products. For this a "cast iron pricing mechanism", in the words of Redacted would be required for the energy (meaning not subject to change as a result of government policy) and this should be achievable from an energy from waste plant. Dairies would be no more susceptible to flood risks than any other, but it is vital that the local road always remain passable. 5 or 6 miles to the motorway junction is not an issue for them. We understand that proposal options for the construction of a new M49 motorway junction are likely to be brought forward by Highways England in the near future.

Cold storage also appears to be a very suitable sector. Redacted have built a large frozen food distribution centre very near the SERC (in the Central Park Development). Construction started in April 2014 and they have just had their first anniversary. It is not mentioned in the PB report (perhaps it is too new for the databases). Redacted were extremely interested in the opportunity for a supply from the SERC. They have outsourced their energy advice to consultants Redacted, who were contacted. The energy consumption (electricity for chillers mainly, no gas) of this new facility is relatively modest at Redacted kWh pa (around Redacted on average). Although not a big demand the understanding behind the investment decision is highly relevant. The cost of the energy is very important ("critical"), but the low carbon aspect less so. The facility was built under the 57/58 planning consent and this was considered "quite valuable" (although they did still consult with the planners). They considered many locations and the decision was based on the whole package, but the respondent could not pick out any single 'clincher'. They consider the local infrastructure to be relatively good. They went ahead knowing about the motorway junction issue and on the basis that there would be some period at least before it was built and they took it on trust the new junction would be built. If it is not built, it would be a "nuisance". The main staffing/skills issue they have is that not everyone is prepared to work in an environment at -25°C.

Chilled food processing (for example sandwich assembly) needs to be close to the customer and every half hour counts towards freshness when it comes to delivery. Chilled foods also seem appropriate to the Enterprise Area. The general food and drink industry is less energy consuming that frozen foods (costs around ~1.5% of turnover, with staffing between 40 and 70%). Low carbon is of variable importance and most important to those supplying directly to prestige retail organisations (and were mentioned).

In general the skillsets required by the food and drink industry is changing fairly rapidly. It used to require mainly low skilled jobs, but with increasing automation the number of jobs is falling and the level of skill rising (including requirements for instrument and control engineers which are difficult to satisfy). The skills background

from the aerospace industry may benefit the region regarding this and helps reinforce the suitability of this sector to the Enterprise Area.

While brewers were not contacted directly, there were a number of discussions with malters (which is the more intensively heat consuming part of the supply chain). While, for the same reasons as malters, a large scale brewery is less likely to locate in the Enterprise Area (although it should not be ruled out) a smaller local brewery would be a possibility (and there are a handful in the Bristol area).

Rendering

Animal rending requires significant amounts of heat to process the products and remove water. The process tends to have odour issues (as can delivery lorries). Currently, thermal oxidisers are used to destroy the odour but there is a review of Best Available Technology underway which might mean that thermal oxidisers no longer qualify as BAT. This could trigger need to reinvest or move, which means they may be interested in feeding air into the SERC combustion air system. If this is not possible, it is likely that the renderers would need a combustion plant anyway, which would negate the benefits of heat and power supply from the SERC.

There are restrictions on what can be done with some of their by-products, so these companies tend to be interested in energy from (their) waste anyway. Other than Redacted they are all family owned, so they are quite entrepreneurial. They find they need a certain type of worker, some people leave after a few days and others will spend their whole career there. The 57/58 consent would be a significant attraction to this industry. This is not a regional industry (although historically there happen to be a lot in the north) and so the south west is suitable and they collect materials from all over the country.

Data Centres

Data centres are in many ways ideal for the Enterprise Area, apart for the significant concern regarding flood risk, already mentioned. Energy (electricity currently) represents about 50% of opex and 11-18% of turnover. Data centre power requirements range from 1 or 2 MW up to 220 MW capacity. They tend to vastly over specify electrical capacity (they call it “provisioning”). There is a concept of “co-providers”, this is where a company sets up the data centre and various users move in and share the facilities (except the banking sector for security reasons). Cheaper (private wire) power for servers and replacing electric cooling with absorption chillers could yield very attractive economics. While reducing the capex requirement is also attractive they are able to raise finance more easily than most other sectors. There is no strong regional preference (other than the data centres for financial institutions need to be inside the M25). The one element of local infrastructure required is bandwidth. If there are areas of the Enterprise Zone which are elevated and free of flood risk (fluvial, pluvial or coastal), or a plan can be put in place to elevate areas or otherwise lower the flood risk to better than 1 in 1000 years, then data centres could be highly attractive Other than security guards and a few highly skilled technical staff, they do not employ large numbers of people.

Speciality Chemicals/Pharms

The Enterprise Area has a heritage in this sector via ICI and so some of the skills will remain, although probably dwindling. The chemical industry tends to cluster quite strongly but further downstream products might still be possible. Security of supply is very important (mostly batch processes, so not quite as critical as bulk chemicals). This sector was much more concerned than most of the other larger manufactures about obtaining low carbon energy. Image is very important. This sector sell to companies like Redacted and it is very important to them and that their products are "natural". The speciality chemicals and pharma sectors are possibility for the Enterprise Area (and Bristol University School of Chemistry is very strong), but bulk chemicals less so.

Bulk Chemicals on the other hand tends to cluster very strongly and this today puts the area at a disadvantage. There was a significant number of plant closures as production moved overseas, but some reshoring has commenced. This has been driven by a rethink of quality v's cost, where production in the UK is better quality and more reliable. The product turns up on time. Low cost is more important than for speciality chemicals and pharma and low carbon less important (but in common with many, they "can see it coming"). Many products are exported, so good access to the port is a valuable benefit to the Enterprise Area for this sector. Good roads and related infrastructure is important, including they felt rail passenger access to get the potential investor to visit in the first place. The sector is also attracted to outsourcing its energy requirements, so that it can focus on its core activities.

General Manufacturing

This is a bit of a catch-all category and the view was that investors' interest in costs scales with size of energy demand and that total cost is the driving factor. Carbon savings was more of a nice to have. Clusters are important due to most upstream and downstream processes and that this even extends to overseas companies who may wish to talk to others who have invested in the area previously (especially if they are from their part of the world). This helps them understand the issues and lowers their perception of risk. The view was expressed that established infrastructure can be good to beat competition elsewhere or as a counter to grants available elsewhere, but that expert resource is required to analyse this and explain it to the customer. For such a broad sector the conversation was quite wide ranging and non-specific, but did generally reinforced the messages from elsewhere.

Glasshouses or "Protected Edibles"

From an energy point of view this sector seems ideal (hot water at 60°C is ideal) and a lot of growers are based on the south and east coasts, but the Bristol /S Gloucestershire region is still suitable. Access to the distributors' warehouses is important. One respondent took the view that there were enough of these. Another said they considered access via the M4 and M5 to be good. It is a high volume low cost business and so low energy cost energy cost is very important. It is close to retail so low carbon emissions is also important. Growers need to continually demonstrate to supermarkets that they are investing in the things the supermarkets

are looking for, such as sustainability. However, one respondent said there are probably more potential heat sources available than glasshouse development opportunities.

Some growers have developed AD plants to process their own and others' waste, the biogas feeds micro turbines which produce heat, power and CO2 for growing. This is very efficient. (Tomatoes, cucumbers and peppers all need CO2 for forced growth).

The sector has consolidated so that now there are only about 4 larger growers who might develop a large facility (10-20 acres).

It was reported that the sector is so efficient and so competitive that "either the heat or the CO2" needs to be free. A project will not happen without a source of CO2. A specialist consultant in this sector commented that "If the heat was very cheap and the CO2 was £20-30 /tonne of CO2 then it might work". Plants that do not require CO2 tend not to have all year round growth. **"Without CO2 it will not get built".** While it may be technically possible to capture the CO2 from the SERC, it is likely to be expensive to retrofit and it would probably require lender approval.

It is understood that horticulture is exempt from business rates, so this sector is not ideal from the councils' points of view.

6 MECHANISMS USED TO ENCOURAGE RELOCATION AND KEY INFORMATION THE COUNCIL AND LANDOWNERS REQUIRE.

Relocation of facilities is extremely rare.

It was clear that the vast majority of companies will first seek to expand existing facilities (due to benefits of scale, less upheaval to workforce, proximity to input materials, markets etc), rather than move to a new location. If existing operations have a particular need for low cost or low carbon energy, then it is usually a lot less capital intensive to develop new energy facilities at the existing location than it is to move. There were examples of this in Paper, Panel Board, Meat Rendering.

The only company contacted which had closed a facility and relocated was Redacted Foods. They moved dairy production from Redacted to Redacted which in turn was closed Redacted when a new dairy was opened in Redacted. Significantly, energy costs are important to Redacted and a new anaerobic digestion plant was developed at Redacted by a third party to service the new dairy. They described their choice of Redacted as being a "balance" of the above factors.

More common is inward investment to build new facilities (i.e. to introduce new capacity in the market or to displace less efficient plants belonging to competitors). Examples of this are Redacted (Bioethanol), Redacted (Bulk Chemicals), Redacted (Frozen Food -25°C Store) and Data Centres. The Redacted bioethanol plant was located where it is because of Redacted, which is a planning consent very similar to the 57/58 consent. This was an example of a start-up company needing to demonstrate to lenders that they had a site with planning permission before they could make further headway. Although low carbon energy supplies were always

important, this importance increased later. Redacted located their Redacted next to their existing Redacted This is a classic example of the clustering of the chemical sector. Redacted appeared to have chosen the Enterprise Area for a balance of reasons, but clearly the new facility does not currently benefit from particularly low electricity costs (the chillers are all electric) or have any low carbon features, so those were not the reasons, it was more about location, infrastructure and the overall deal. Data centres are being developed in many regions and low cost energy is important to them, but they require a site with negligible flood risk, that can be made secure and with bandwidth available.

Of course, marketing is one of the key mechanisms used to reach out to industry sectors. Websites and other scattergun approaches have their place, especially for the sectors identified as being less likely to invest and as a mechanism to trawl for other sectors as yet unidentified. However for those sectors identified above, a more selective sharpshooting approach is appropriate. Direct contact, cold calling of companies is unlikely to be successful. It would be difficult to identify the right person (probably very senior and 'protected' by their staff) and even then the chances are the timing will be wrong. In order to find the person with the 'need' it is best to use established channels. In the past this was the development agencies, but now the LEP and UKTI.

In order to understand how these and other organisations can successfully craft propositions, it is necessary to understand inward investors' specific requirements and concerns, as follows:

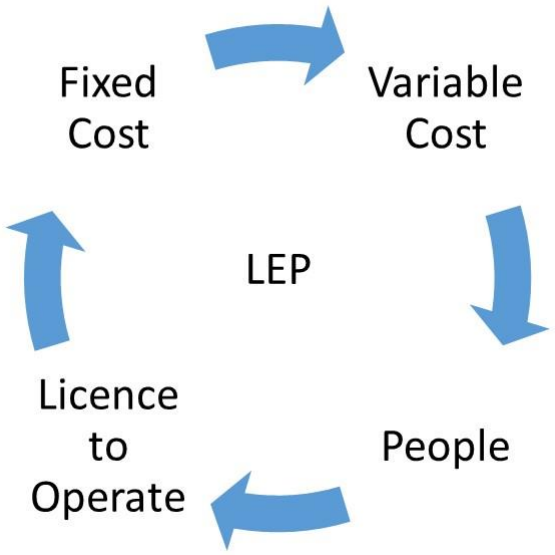
> Experience suggests there may be a great many 'serious enquires' from companies over a period of several years regarding investment in the types of business the Study Partners are seeking to attract. By 'serious enquires' we mean companies/investors who seek detail, expend significant resource, enter into meaningful debate and who come to the area to meet the local stakeholders/landowners/energy providers. However, experience also suggests that the ratio of 'serious enquiries' to those which go on to invest is in the region of: Redacted. There is therefore potentially more opportunity to learn from those which did not go ahead than those which did.
>
> Looking across the spectrum reveals a contrast between those who invest and those who do not. **Those who do invest have in common that they are either in a hurry or have already made up their minds to invest almost from the outset.** To understand this we need to understand the nature of their businesses and their decision making processes.
>
> Firstly, any business/facility which is likely to require significant amounts of energy is also likely to be relatively asset intensive and require very substantial capital investment.
>
> Secondly, the opportunity to obtain substantial capital investment may have a relatively short window.
>
> If the investor is making the investment on balance sheet or out of its own funds then there may be internal competition for funds and resources.

Significant management time is required and, particularly in a very large company or multi-national, their attention cannot be held indefinitely. An individual manager tasked with delivering a new development may be given deadlines, or at least targets, as well as finite resources. This puts him/her in a hurry for answers or to find a solution quickly, even if it is not perfect. The top three questions an inward investor first asks are about grants, skills, assets/infrastructure. Energy costs will come in to the picture if they are relatively energy intensive users.

If the investor is setting up an off balance sheet SPV (or in the more extreme case is a start-up company) then there is very likely to be limited resources and development budget available to them. A start-up company will be rapidly burning through seed capital and will probably be in a particular hurry. This type of investor may be trying to bootstrap up their project and the fundamentals they require (besides a viable business proposition) are 1) a site with appropriate infrastructure/location and 2) planning consent (or very high probability of receiving planning consent without issues). Lenders are not likely to engage if either are missing. For a business which will require significant amounts of energy, obtaining attractive commercial terms for supply of that energy may also be very important, but for start-up companies the 57/58 planning consent may be even more vital.

A model to service the needs of investors is set out below:

Figure 2 Model to Attract Investment



The LEP co-ordinates all activities, performs research on the industry, identifies what is most important to that industry and puts a bespoke proposal together. They should respond knowledgeably to all enquiries within 48-72 hours. Some form of techno-commercial resource is probably required. The LEP puts the overall package together and the relevance of the ‘single package’ is particularly important for start-ups and overseas investors.

Licence to operate includes provision of a suitable site, the 57/58 planning consent and the willingness of the local authority to put together a bespoke team of people. In addition, where appropriate, the EA and HSE should be pulled in to show they understand the needs of the business and willingness to work with them.

Fixed costs may be reduced by providing a suitable site with existing infrastructure (made up roads, nearby utilities and telecoms etc) and a good price for the land. The cost can be further reduced by the energy supplies from the SERC and/or communal backup boilers. This is where grants come in. Obviously it is good if the Study Partners are able to offer grants. One mechanism the Study Partners could consider would be to obtain Enterprise Zone status for the Enterprise Area. This provides enhanced capital allowances which are of benefit to companies already profitably operating in the UK. They may also be attractive to start-up companies or companies new to the UK if they intend to flip the project once it is up and running. Where grants are not available and/or when an inward investor's attention has been caught by grants elsewhere, it may be possible to more than counteract that by lowering the fixed costs at the Enterprise Area. An example was given by one respondent where an inward investor could have received a £12m grant elsewhere, but which was counteracted by a 25% saving on infrastructure costs. The price of the land is equally important to any other fixed cost, it is just a cost. Of course of the Study partners are able to lower fixed costs by some of the means suggested, there is a chance the land owners may seek to take some of that value, but competition between them may help to suppress this (another reason to treat them equally).

Dealing with **variable cost** not only means sharing some of the variable cost savings from the SERC, but also providing long term deals and removing uncertainty. The SERC needs to be prepared to provide long term pricing structures and be able to convince the offtakers that there is little risk of regulatory interference disrupting the arrangement.

The details of the commercial offer from the SERC will of course vary from customer to customer, as they will depend on with the size of the load, the conditions of the heat (z-factor) and the level of security of supply required. However for more general marketing purposes, it is still possible for the overall pricing strategy to be set out and it can be made clear that it is attractive (based on the z-factor economics described above)..

The headline marketing material should promote that the heat and power is cheap, sustainable, low carbon and reliable. At the next level of detail should be descriptions of:

- the SERC,
- its capabilities to supply heat and power,
- why it is cheap, reliable and sustainable and
- a high level description of pricing strategy.

The **people** aspect refers to both the people to be employed and the decision makers. The right skills and workforce need to be available. However there is also

an aspect of playing the man rather than the ball. The new CEO will want good schools, a nice area to live, good healthcare and if they are from overseas, possibly an existing community. Where possible, these aspects should be directly addressed when first showing people round.

An extremely effective mechanism, which has been shown to work elsewhere, is for the **landowners to sell to potential investors options to buy parcels of the 57/58 consented land.** As described above, the potential investor may well have a very limited development budget and timeframe. An option to buy consented land, instantly gives them two of the key things they need to start raising finance. When the developer approaches lenders, the first thing the lenders will ask (other than about the project itself) will be whether they have a site and has it got planning permission. If the developer's answer is "no", they are likely to be told to come back when they have and the lender is not going to put their resources into the project until those conditions have been satisfied. The land option route is not only quick, but it is relatively inexpensive. In fact, the land owner will get some income for land they may not otherwise get and the option only needs to be for, say, 18 months, so the land is not tied up for long. A licence to occupy can also be granted to allow some preliminary activities to occur (such as site surveys, which will also serve to satisfy lenders). The price of the land when the option is exercised is important too.

An attractive proposition for heat/cooling/power from the SERC is also an important factor. It would be best if a pricing methodology was prepared by the SERC and consistently applied across all landowners and potential investors.

Another mechanism is to encourage the customers of inward investment sectors to push those investors towards the Enterprise Area. It has been mentioned several times that those investors closest to the consumer have the greatest interest in low carbon heat. Therefore, without being specific about any particular inward investor, it may be valuable to educate supermarkets and manufacturers of premium products about the opportunities available to their suppliers.

Drawing from the above, we can see that the type of information the Council and Landowners need is likely to be:

- A route to market, such as a network of contacts at the UKTI, CBBC, overseas embassies, industry trade associations etc. The Council and landowners need names and relationships.
- The views of political influencers (MP's, council leaders etc) on the potential developments, identify any which they would fail to support and concerns they may have.
- The inward investment team needs to understand the processes of the various industry sectors.
- We now understand the basic principles SERC's heat and power economics, but we also need the SERC's pricing strategy.

- The limits of the SERC imposed by its lenders and shareholders (ability to modify the plant, take on commercial and financial risk) and the timeliness of its approvals process
- Landowners' land development strategies. Build out plan and plan for developing site access roads and related infrastructure.
- Details of the recently built facilities and their energy requirements
- Land prices.
- Detailed site plans.*
- Routes out of the Enterprise Area for the future wider heat network*
- Ground conditions reports (Phase 1 desk study and walkover at least)*
- A co-ordinated utilities plan, including current drainage plans, broadband availability, availability of effluent treatment and waste disposal.*
- Identify existing infrastructure and quantity cost savings that infrastructure brings to an inward investor.*
- Detailed model of flood risk with dynamic consideration of interactions between potential developments and a costed mitigation strategy*.
- Logistics overview*.
    - Traffic plan and a landing on the motorway junction issue.
    - Robustness of local roads to access the motorway at all times.
    - Rail network access development plan.
    - Port capabilities (vessel size and loading/unloading capabilities).
- Details of specialist support service companies in the area*.
- Raw materials availabilities in the region*
- Availability of grants for the area.
- Reports of demographics and skills in the area*.
- Plans to deal with queries on any of the matters referred to in Appendix 5.

*****This information may require further studies (see section 9).

The above bullet points form the beginnings of the Study Partners' marketing plan.

7 RISKS AND MITIGATIONS

The biggest risk is the lack of an overall planned and co-ordinated approach to inward investment. To mitigate this, there should be a single organisation acting as

point of contact to answer all queries and provide a unified offering as much as possible. The best placed entity to fulfil this role is probably the LEP.

That lead entity (or rather the key lead people) need to be knowledgeable, meaning have knowledge, not just have access to knowledge. For example when Redacted was first contacted, they initially said we had been in touch with them before (it had actually been another waste plant) and that they could not risk an unsecure electricity supply as the generator would not be running all the time. When it was explained that security of supply is determined by the connection to the grid, not the operation of the generator, they became extremely interested in taking an electricity supply. Then once we got talking about that, they became interested in a cooling supply. So much so that they put us in direct contact with their energy advisor and authorised release of information. If the person making the initial contact with that company had not had the knowledge to instantly explain the true situation, that customer could have been lost. The same is true for every aspect, planning, land, skills and energy etc –whatever level of expertise the customer might put up, the inward investment team need to match.

Those potential investors who probe slowly, are slow to grasp opportunities, are not quick to visit, who do not rapidly address the key 3 points above, are more likely to be one of the "Redacted", but they do still need to be responded to just the same. It could just be that they are preparing the ground.

If a potential investor is asking about what grant funding is available, it might seem like a bad sign (that their business proposition may not be viable without it), but it is actually quite common. Grants may be on offer somewhere else or some form of incentive may be required to level the playing field (e.g. against cheap shale gas in the USA). As described above, good existing infrastructure, low cost heat and a bespoke proposal can successfully counter this.

In the case of the Enterprise Area there appear to be three competing landlords, so it is unlikely that they will co-ordinate well between each other. Therefore the Study Partners will need to provide a consistent offering to all three and treat them equally. This competition may cause the landowners to be reluctant to share information about potential inward investors with the Study Partners, LEP etc. Therefore there needs to be scrupulous confidentiality in this regard.

They are also probably more focussed on land sales/rental than heat sales. There is therefore a requirement to sell to them the benefits of attracting a major energy consumer.

Preferably nearer ones should not be permitted to land-lock the SERC from the others. They may also sell off the land closest to the SERC to non-heat consuming companies or otherwise develop land in a manner which subsequently makes distribution of heat more expensive or impossible. To mitigate that, it may be possible to persuade them that land nearer to the SERC is a premium and should be reserved.

The partners cannot afford to openly disagree with each other in front in potential inward investors. Therefore there needs to be an agreement on priorities. For

example, the stakeholders should attempt to agree up front what would happen if an investor came along with a project that did not consume heat, but did provide jobs. This can perhaps be dealt with in advance by zoning the land. It would be difficult to do if the investor had already been shown a particular plot.

Another example of potential disagreement is the potential for land raising by development under the 57/58 consent to increase flood risk elsewhere. If this issue cannot be resolved, then some parties may need at least to become reconciled to it.

Any partnership is likely to break down if any of the partners feel they do not need each other and/or any of the partners cannot deliver what is needed of them by the others. Therefore the partnerships should be formed in the first instance on the basis of need/benefits to each other and each partner must commit to allocate sufficient resource to deliver what is expected of them. It should also be established up front and communicated to everyone what those expectations and roles are.

It was suggested above that the Study Partners should engage with the inward investment side of UKTI. However UKTI has been restructured and is now much harder to access and it is more opaque than previously. A lot of their responsibilities were outsourced to consultants who have been given specific scopes of work and who are unlikely to take on additional activities. While it may be possible to work though this, there may be a need to make some contacts overseas directly. For example the US government even some US states have teams that can be contacted directly. The China Britain Business Council (CBBC) may also be able to help and have locally based representatives (although their primary role is to help British companies win business in China).

Other agencies (such as UKTI, EA, HSE) may be reluctant to engage in the necessary support processes, so as the whole package is developed, those organisations should be consulted a senior level to get senior level commitment. MP's and council leaders will have to buy in and give their commitment, if they have not already done so.

The Amion report mentions increasing flood risk and some nature conservation/ecology issues. A positive plan needs to be put in place to deal with these. For example Seabank and ICI operated there successfully for years and the SERC is being built there. The SERC will not have been built there without significant due diligence on these issues having been performed on behalf of its shareholders, lenders and the waste authority. It would be useful if this knowledge was shared.

The PB report describes that heat from the Nexterra facility may have a negative cost. It would not be the councils' role to favour one heat source over another, so the councils should consider how to include other potential heat sources to the development of the Enterprise Area on an even handed basis. It is noted however that the SERC is closer to most of the 57/58 land than Nexterra.

8 RELATIONSHIP WITH THE EXISTING OUTLINE DEVELOPMENT STRATEGY

In section 1.1 of their report, Amion wrote that:

"…the future development and role of the area is challenged by…:

- the 1957/58 planning consents to the (then) ICI Chemical Works in Severnside, which remains extant, leading to:
    - the potential for unconstrained development and a lack of co-ordination with other parts of the area; and
    - limitations on the ability of the local authorities to realise infrastructure improvements through the development control process; and
- close proximity to the national motorway network but limited motorway connectivity and local network capacity".

While we agree that the 57/58 planning consent could lead to uncoordinated behaviour and land raising could create flooding elsewhere, overall we consider that the 57/58 consent is a considerable advantage to meeting the specific objective of attracting investment to that land. (However in our direct experience, there is a chance that it may seem to some investors to be too good to be true, so the council should be prepared to make supporting statements in this regard).

The limited connectivity to the motorway network did not show up in the Energis survey as being a particular initial concern. More important to respondents was simply that the roads to the motorway network should always remain passable. However, the context of the questioning was from the narrow view relating to a specific investment and not the broader position of the long term strategic development of the area. Therefore we do not consider this to be a contradiction of the Amion recommendations.

Flood risk, or perceived flood risk, is a barrier to inward investment. In addition to the normal costs and disruption to investors' operations, there is a significant safety hazard and risk of damage if steam pipelines should ever be flooded. If flood water came into contact with a live steam pipe, the steam in the pipe would condense to form a slug of water that would be driven very rapidly along the pipeline (by the remaining steam). This would then hit an obstacle, such as a bend or a valve, causing "water hammer". This can be so violent as to cause the pipeline to jump off its mounts, which could cause serious or fatal injury to anyone in the way. It would also put the line out of commission for a significant period. This can be managed by monitoring the situation and shutting down the steam main when there is a risk of flooding or it can be prevented at the design stage by elevating the steam pipes. Given the relatively high expectations of steam customers regarding security of supply, the latter approach is probably required, making this also an issue of up-front cost.

9 FORWARD PLAN AND SCOPE OF WORKS

9.1 Organisation and Governance

The Study Partners will probably already have identified their overall level of resource for district heating and there will be resource in place to support the Development of the Enterprise Area. The activities required to achieve the Study Partner's objectives to attract anchor heat loads are probably more closely related to the latter. Therefore the first steps are to set up or reinforce the appropriate structures, funding & resources and to obtain local political support and commitment. The resources should ideally include a dedicated inward investment team with sufficient technical, commercial and financial understanding of the issues. Preferably a single individual or accountable body should lead the process, such as Invest in Bristol and Bath.

9.2 Engagement of Stakeholders

Procurement of some of the necessary information, as well as subsequent marketing & sales activities, will require the buy in of a number of stakeholders including the landowners. They should be 'sold' the benefits of attractive heat customers and of adopting a co-ordinated approach, including zoning of developments. A plan to deal with issues of confidentiality and conflicts of interests should be developed between the stakeholders.

Other potential sources of heat should be invited to participate from the outset.

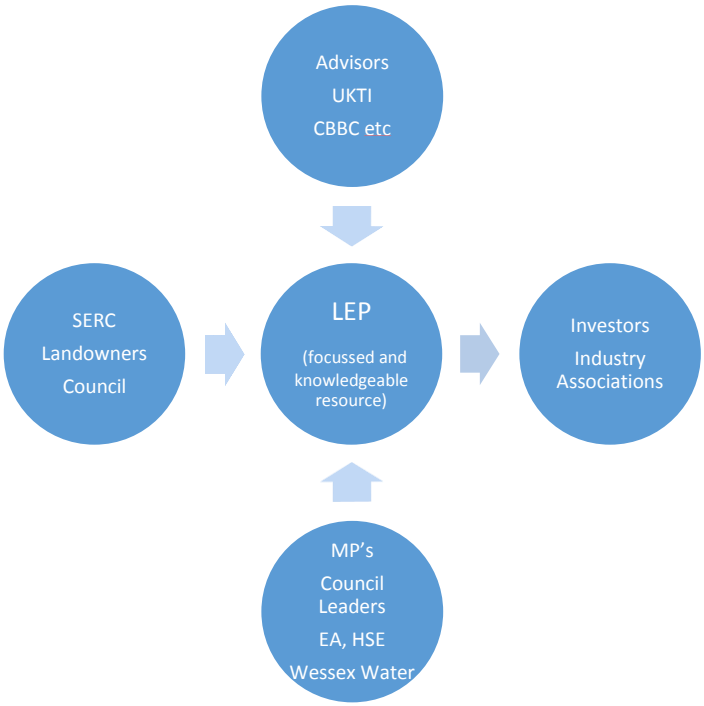
If the land owners perceive that the heat and power available from the SERC could add value to their proposition they are much more likely to be cooperative. This might be one way to get a more coordinated approach to such matters as zoning and ground raising.

One key marketing tool the landowners could bring to the table would be the sale to inward investors of options to acquire plots which enjoy the 57/58 consent, as described in in Section 6.

Next, the stakeholders need to organise themselves i.e. agree who is doing what. Most roles may seem fairly obvious, but the boundaries and interfaces should be formally established to avoid confusion, stepping on toes and subsequent upset.

The basic building blocks are shown below in Figure 3

Figure 3. Organisation



9.3 Stakeholders to Provide Information

The stakeholders need to provide the information listed in the bullet points in Section 8. The SERC will need to establish technical and commercial resource to respond to any enquires and liaise with the inward investment team.

9.4 Business Model to be Established

The business model needs to be established and decisions made regarding who will make the investment for the connections, rates of return etc and who will be responsible for operating the systems.

9.5 Details of the Enterprise Zone

The information marked * in the bullet points in Section 8 needs to be sourced. It may be that some of this can be provided by the stakeholders, but a number of areas may need to be outsourced to specialist consultants (one or two contracts).

9.6 Implementation

Once the above has been completed the inward investment team can start to market the Enterprise Area (it would be a mistake to start to generate significant enquiries until ready).

The key elements of a marketing plan are:

- Identifying the target customers. Further selection of target investors is probably not required. It could be possible to be over-selective. However much more understanding of their needs can still be gathered. This is probably best achieved via their industry associations.

- The objectives. The stakeholders need to agree what success looks like. Is it several small heat customers of 1 or 2 MW or much larger? What is the role of private wire power supplies? (Reference page 5 and the separate confidential presention).

- The Unique Selling Points available. The Energis survey work established just this and their relative importance for different types of customer (particularly section 5.2). When targeting different sectors, the USP's should be tweaked accordingly

- Pricing strategy. One of the potential USP's (if the SERC is willing to share the benefit) is low priced heat and power. Care should be taken at the initial stages that 'low carbon' heat and power is not interpreted as expensive heat and power.

- Route to Market. This is how the inward investment team will reach the key people in the right organisations who have the 'need' at the right time and deliver to them the right message. This can begin with a similar approach to that adopted by Energis for this study. Industry Associations are generally enthusiastic about promoting their industry and, where they see good alignment, are willing to share information regarding the development opportunities at the Enterprise Area with their members. They have large numbers of members and direct lines of communication with them and they understand their business needs intimately. Furthermore, they are likely to have the time and will often feel that it is their role to help out. Invitations to present to gatherings of their members would be invaluable. Specialist consultants may hover looking for work and are a good source of network contacts. The traditional route of UKTI should also be used and direct approaches made to overseas business growth support functions. CBBC and similar organisations may also be able to help. It may be worth the inward investment team joining organisations such as the ADE and the REA.

Once an enquiry is received, the model shown under Figure 2 (page 22) comes into play. The co-operation of the stakeholders described above and expertise of the inward investment team is vital. They have to know the technical and commercial detail and be responsive and attentive. They need boundaries within which to operate and means to obtain decisions quickly from stakeholders when matters stray outside of those boundaries.

The LEP and Councils may wish to consider pursuing grants and Enterprise Zone status. If possible, funds should be obtained for infrastructure development.

Appendix 1 List of the large consuming industries

Process	Typical Heat Demand MW	Typical Conditions	Z factor	Power MW	Initial Screening Comments
Steel	1,000	direct heat @ 1500degC	1	100	not possible to supply from SERC (422degC)
Cement	500	direct heat @ 1200degC	1	20	not possible to supply from SERC (422degC)
Glass	100	direct heat @ 1500degC	1	10	not possible to supply from SERC (422degC)
Ceramics	20	direct heat @ 1500degC	1	5	not possible to supply from SERC (422degC)
Refinery / Large Petrochem	200	Steam @40barg,400degC	1.5	40	too large / no developments likely
Bioethanol	100	Steam @10barg,200degC	3.6	20	too large
Cardboard	100	Steam @10barg,200degC	3.6	30	too large
Sugar	50	Steam @10barg,200degC	3.6	20	seasonal / no new build likely
LNG	200	Hot water @ 45degC	20	5	too large & highly intermittent demand*[1]
Speciality paper / tissue	15	Steam @10barg,215degC	3.6	3	very few plants built
Speciality Chems	15	Steam @15barg,250degC	3.6	3	usually co locate to upstream feedstock
Food / brewing / dairy / drir	10	Steam@10barg,215degC	3.6	3	need to address food hygene regs
Pharma	8	Steam @10barg,215degC	3.6	3	need to address food hygene regs
Wood panel / building prod	8	Steam @5barg,160degC	5.5	3	often use biomass heating
Large General Manufacturin	8	Steam @10barg,215degC	3.6	3	Not all manufacturing plants require steam
Rendering / Waste processi	8	Steam @5barg,160degC	5.5	3	may prefer to burn tallow or other byproducts
Malting (large scale)	5	Steam @5barg,160degC	5.5	2	may prefer direct gas drying
Animal feed	5	Steam @3barg,135degC	6	2	
Large Glasshouse	5	hot water @ 60degC	9	2	Seasonal (winter/nightime peak)
Cold storage	15	chilled water *[3]	9	4	Seasonal (summer peak)
Data centres	10	chilled water *[3]	9	4	Seasonal / extremely high reliability required

Notes

1. One of the earlier reports mentioned that a smaller baseload demand may be available at the nearby LNG terminal

2 direct gas dryers often used in tissue drying

3 heat could be used to drive absorption chillers in place of electric refridgeration

Process	Typical Heat Demand			Power	Assumed counterfactua	Counterfactual Costs			SERC costs			Viability Analysis				
	MW	Typical Conditions	Z factor	MW		Capex[4] £M	Heat[2 3 5 6] (£/hr)	Power (£/hr)	SERC capex[7] £M	Heat[8] (£/hr)	Power[9] (£/hr)	Hourly saving £/hr	Annual saving £Mpa[10]	Trench cost (£/m)[11]	Distance for payback on power &	Distance for payback on heat only
Speciality paper / tissue	15	Steam @10barg,215deg(	3.6	3	gas CHP & gas boiler	7.5	272	191	3.9	181	123	159	1.00	2121	3298	1909
Speciality Chems	15	Steam @10barg,215deg(	3.6	3	gas CHP & gas boiler	7.5	272	191	3.9	181	123	159	1.00	2121	3298	1909
Food / brewing / dairy / dr	10	Steam@10barg,215degC	3.6	3	gas CHP & gas boiler	6.0	160	191	2.7	121	123	107	0.67	1738	2717	1005
Pharma	8	Steam @10barg,215deg(	3.6	3	gas CHP & gas boiler	5.4	115	191	2.2	97	123	86	0.54	1557	2447	528
Wood panel / building pro	8	Steam @5barg,160degC	5.5	3	biomass heat, grid pow	6.7	136	243	2.2	66	123	190	1.20	2363	3541	1319
Large General Manufacturi	8	Steam @10barg,215deg(	3.6	3	gas boiler , grid power	2.7	194	243	2.2	97	123	217	1.37	1557	6155	2810
Rendering / Waste process	8	Steam @5barg,160degC	5.5	3	gas / tallow boiler , gric	2.7	194	243	2.2	66	123	248	1.56	2363	4628	2419
Malting (large scale)	5	Steam @5barg,160degC	5.5	2	direct gas / gas boiler ,	1.7	121	162	1.4	41	82	160	1.01	1865	3784	1912
Animal feed	5	Steam @3barg,135degC	6	2	gas boiler , grid power	1.7	121	162	1.4	38	82	163	1.03	2032	3538	1819
Large Glasshouse	5	hot water @ 60degC	9	2	gas CHP & gas boiler	3.5	61	127	1.4	27	82	79	0.50	1020	3411	1477
Cold storage	equiv 13.5	chilled water *1	9	4	electric chiller plant (C	0.4	0	320	3.4	60	40	220	1.39	1040	9327	6995
Data centres	equiv 9	chilled water *1	9	4	electric chiller plant (C	0.4	0	320	2.4	40	80	200	1.26	1040	8480	4240
															7.0 year payback	

Commodity price assumptions

	£ 17.95	/MWh retail gas+CCL	DECC quarterly prices table 3.1.2 ("Large User") plus CCL assuming 65% CCA discount (22/12/15, showing Q3 2015 prices)
	£ 16.30	/MWh wholesale gas	DECC quarterly prices table 3.2.1
	£ 43.47	/MWh wholesale power	Calculated from wholesale gas
	£ 79.95	/MWh retail power	DECC quarterly prices table 3.1.2 ("Moderately Large User") plus CCL assuming 90% CCA discount
	£ 4.15	/tCO2 assuming 5.4Euro EUETS cost	
	£ 39.95	/£/MWh SERC PPA price (assuming £3/MWh Triad benefit)	
Distance to plant (meters)	500		

Other assumptions / notes

1. chilled water can be produced via absorption chillers driven by hot water or low grade steam. 75% power used for chilling in cold store CoPe= 3.0 CoPh = 1.50
2. Hourly costs assuming commodity prices as shown (taken from DECC quarterly prices index) https://www.gov.uk/government/collections/quarterly-energy-prices) .
3. Achieved boiler efficiency of 80% (**HHV basis**) plus assumed cost of CO2 emission
4. Counterfactual capex assumptions gas boiler capacity @£100/MW (x3 for double redundancy) & power connections @ £100k/MW
5. Counterfactual O&M allowances £10/MWh for engines . £1/MWh for boilers / grid
6. Biomass heat with RHI credit = 70% gas cost (£5/GJ x 3.6GJ/MWh = £18 /MWh th @ 82% efficiency fuel cost = £22/MWh th plus £5/MWh th for O&M less £10 /MWh th= £17 /MWh th). Biomass capex at £0.8M / MWth
7. SERC capex to boundary (piped connections £150k/MWth & power @ £50k/MW) inc single standby boiler @ £100k/MW
8. SERC marginal heat production cost = power PPA lost revenue / z factor plus £1/MWh O&M
9. SERC marginal power cost = PPA lost revenue plus £1/MWh O&M
10. SERC has 2 units available for 7000hrs pa. Assume customer does not require heat for 10% of that time (ie annual savings assume 6300hrs benefits)
11. Steam pipes sized according to Z factor (determines pipe size) & cable cost. Steam & condensate pipes above ground. Hot water pipes as per DECC

Appendix 2 Details of how the Calculations in Appendix 1 are Performed

Please refer to spreadsheet “Heat and Power Load Calcs.xls” cells H36 to X49.

Cells H36 to K49 provide the assumed heat and power characteristics of various industries.

Column M provides the most likely alternative heat and power source for the investor and column N calculates the capex required (based on experience in recent years) for that source at:

Gas CHP plant at £100k/MW_{th} for the heat recover equipment / boilers[3] (x3 for double redundancy) and £1M / MW_e for engine (cells N38, N39, N40, N41, N47).

Biomass boiler £800k/MW_{th} for the boilers (including redundancy) and £100k/MW_e for electricity import connection (cell N42).

Gas boiler or tallow boiler or direct gas firing at £100k/MW_{th} and £100k/MW_e for electricity import connection (cell N43, N44, N45 and N46).

Electricity import only at £100k /MW_e (N48 and N49).

Column O calculates the variable cost of the additional fuel to raise the heat (after allowing for the heat naturally recovered from the engine) then adds the cost of the carbon emissions. The variable cost of biomass, after allowing for the RHI credit, is from experience around 70% the variable cost from gas. In this case biomass is estimated at £5/GJ with an allowance of £5/MWh_{th} for additional O&M e.g. ash disposal & flue gas treatment. General gas boiler O&M costs are £1/$MWh_{th.}$

Column P, for CHP the cost of fuel and carbon emissions is calculated at 35% efficiency and for imports the retail cost of power is used.

Column Q calculates the capex required to build heat and power connections to the SECR boundary based on piped connections at £150k/MW_{th}[3], electricity connections at £50k/MW_e and a single standby boiler @ £100k/MW

Column R calculates the variable cost of heat from the SERC as the wholesale value of the electricity, divided by the Z factor, plus £1/MWh additional O&M cost. For cold stores it is assumes 75% of the energy is used for cooling and for data centres 50% (and the heat demands adjusted for the coefficients of performance).

Column S calculates the variable cost of heat from the SERC as the wholesale value of the electricity, plus £1/MWh additional O&M cost.

Columns T and U calculate the hourly and annual variable cost savings.

Column V calculates the cost per meter of the steam and condensate return pipes together with the private wire. Higher Z factors indicate lower pressure steam which tends to increase the pipe size (to transport a certain quantity of energy). At the same time there is an economy of scale as pipes get larger which tends to follow a square root relationship (i.e. a pipe of double the capacity tends to cost 1.4x the cost

[3] Capex based on a number of years project experience including equipment being installed now.

Electricity cable is costed at £10 /m per MW capacity[3] and hot water pipes (flow and return) at the typical DECC benchmark of £1000/m

Columns W and X calculate the distances the heat/electricity can be conveyed, (based on the payback period entered in cell W50).

Appendix 3 List of Bodies/Companies Interviewed

Redacted

Appendix 4 Survey Results

Figure 1 Raw data

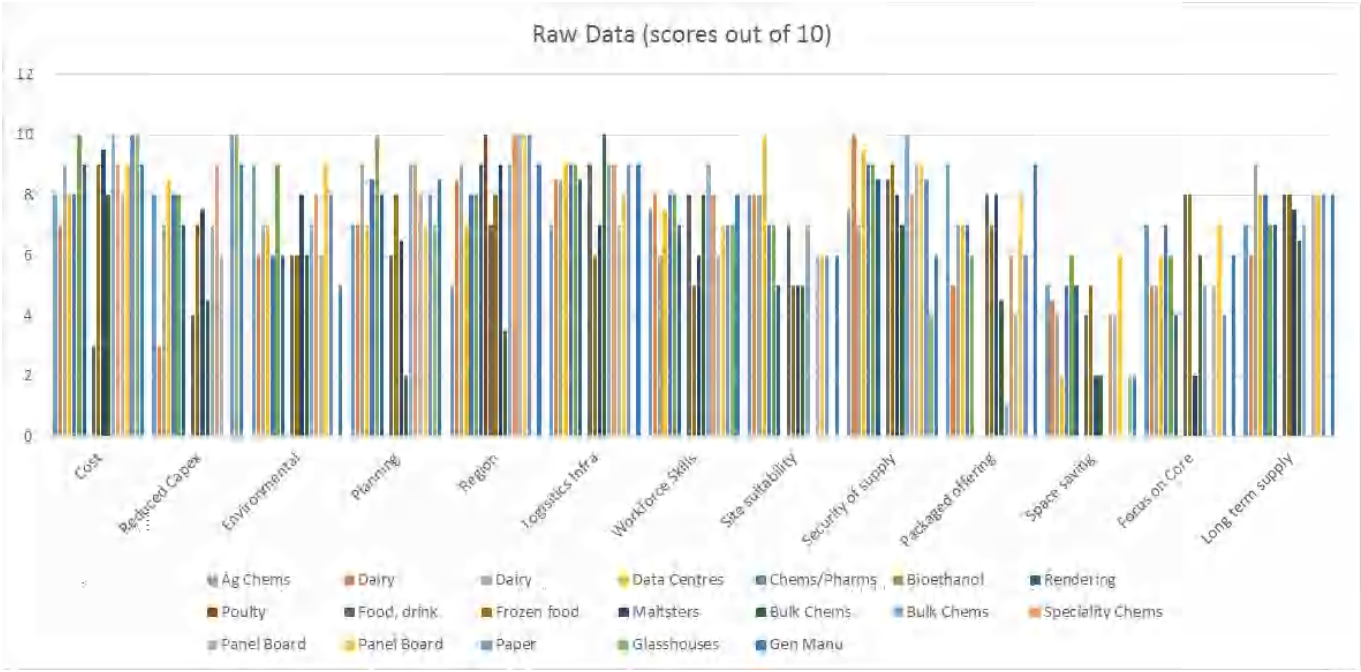


Figure 2 Averages of Raw Data

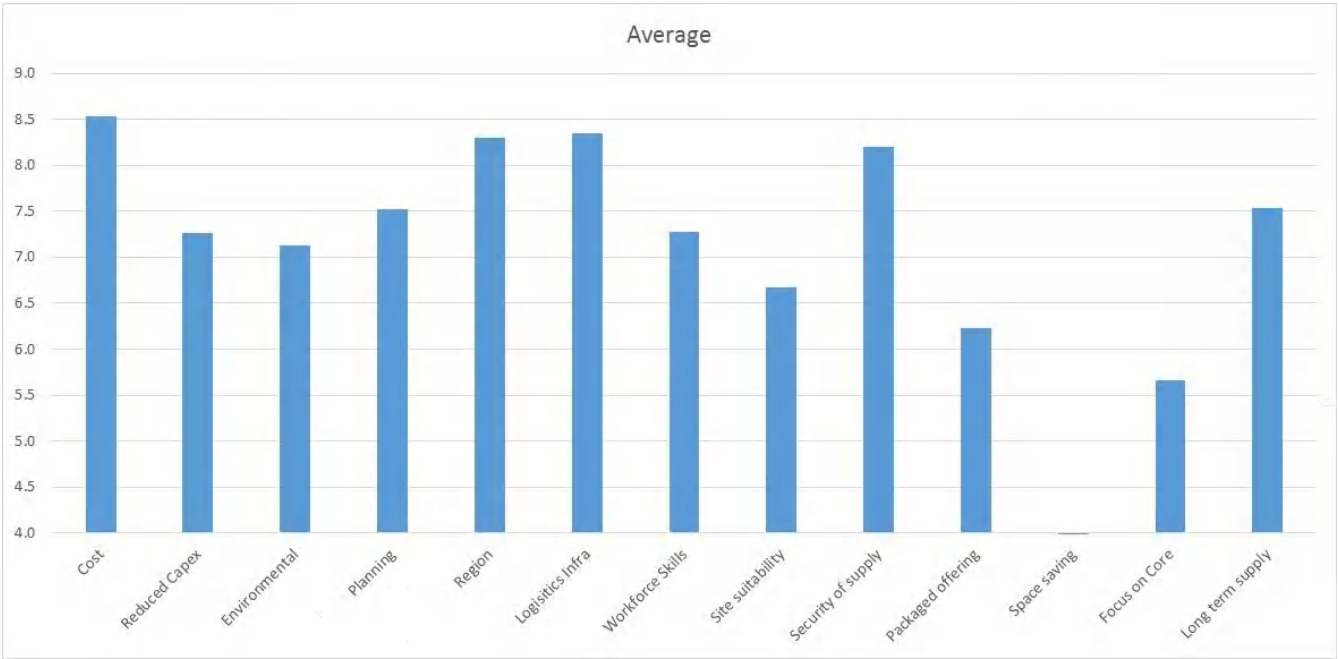


Figure 3 Data for Industries Suited to the Region.

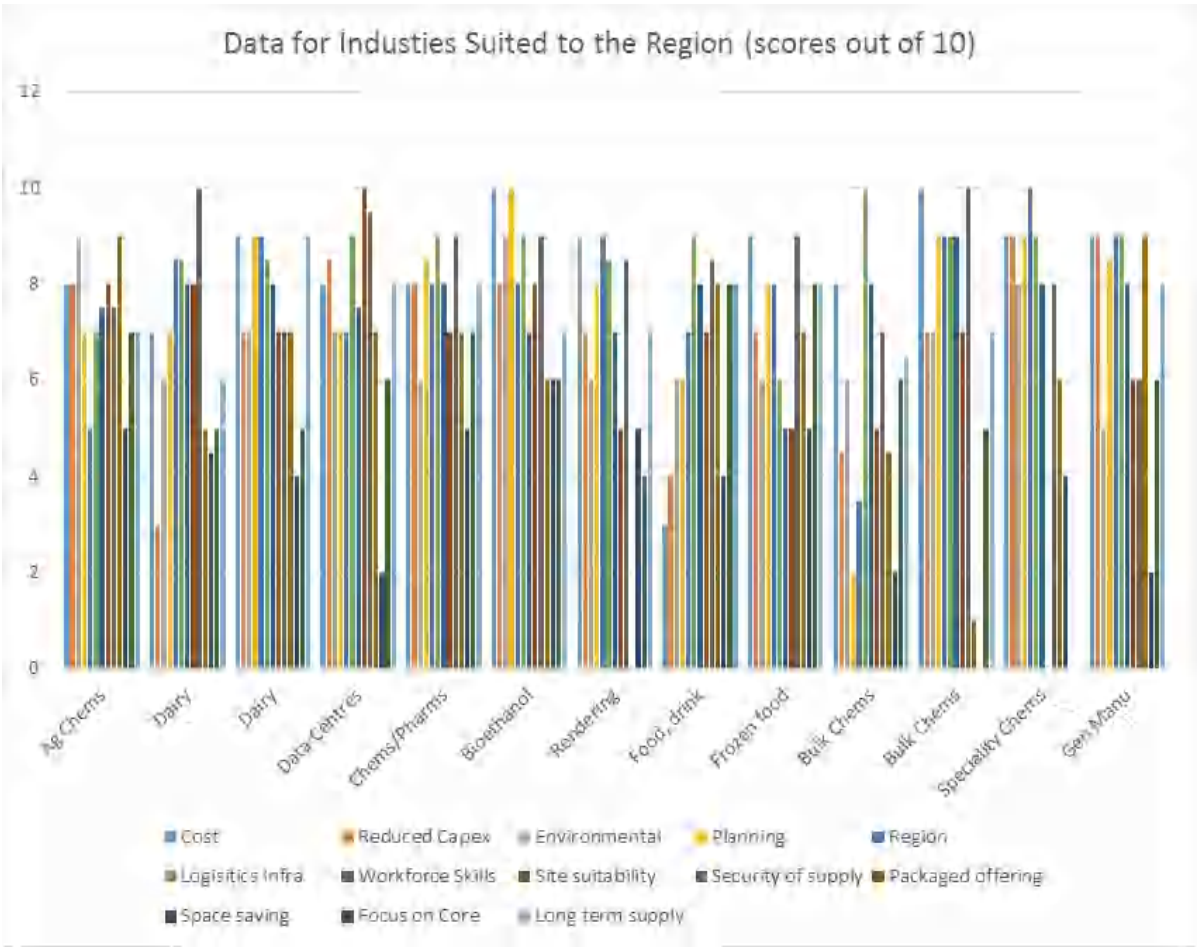
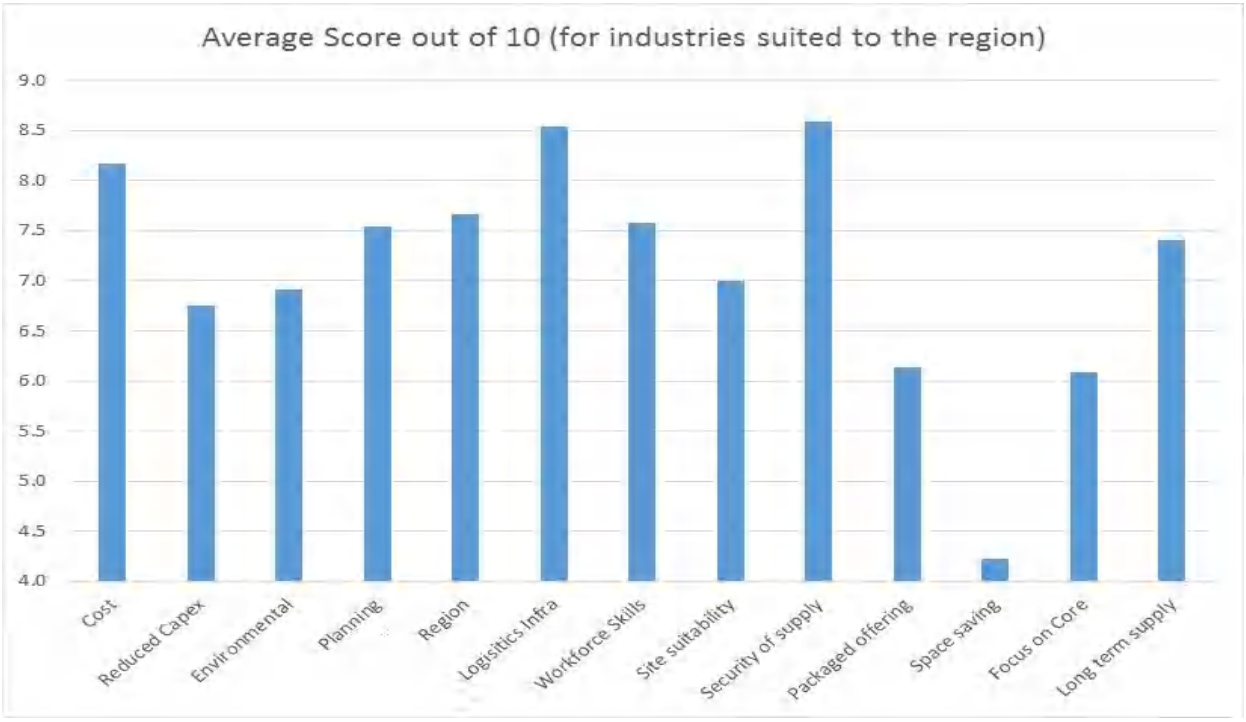


Figure 4 Averages of Data for Industries Suited to the Region.



Appendix 5

The following is a general list of the types of things about which an inward investor may enquire. The inward investment team should be able to provide some sort of support or direction regarding all of these:

- Services
- Supply systems
- Steam
- Cooling and compressed air
- Power
- Nitrogen
- Water
- Utilities management
- Biological waste water treatment
- Health management
- Environmental protection and occupational safety
- Occupational safety
- Incident management
- Authorized representatives
- Emission control / emission measurements
- Emission measurements / air components
- Workplace / hazardous substances measurements
- Hygiene inspections / drinking water
- Waste management
- Contaminated site management
- How to go about obtaining permissions and contact details of authorities
- Facility management
- Warehousing and logistics
- High rack warehouse
- Hazardous materials storage area
- Logistics consulting
- Security service
- Premises security
- Security consulting
- Location, response time and capabilities of the fire brigade
- HR service center
- Personnel service
- Payroll
- Job evaluation
- Work schedule management
- Commercial service
- Technical services
- IT and communications