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ENVISION AESC

IAMP One Phase Two Development

Planning Application and Environmental Impact Assessment

APPENDIX 3.3 Energy Statement

July 2021

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IAMP One Phase Two Development

Planning Application and Environmental Impact Assessment

Appendix 3.3 Energy Statement

July 2021

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CONTENTS

FIGURES

TABLES

ACRONYMS

AIMCH	Advanced Industrialised Methods for the Construction of Homes project
ASHP	Air Source Heat Pump
BEIS	Government Department for Business, Energy & Industrial Strategy
BER	Building Emission Rate
BFEE	Building Fabric Energy Efficiency
BIM	Building Information Modelling
BPER	Building Primary Energy Rate
BRE	Building Research Establishment
CfSH	Code for Sustainable Homes
CHP	Combined Heat and Power
CLC	Construction Leadership Council
DECC	Former government Department of Energy & Climate Change
DHN	District Heat Network
dte	Dry Tonnes Equivalent (measure of wood fuel)
ESCo	Energy Supply Company
FEES	Fabric Energy Efficiency Standards
GSHP	Ground Source Heat Pump
HIU	Heat Interface Unit
IAMP	International Advanced Manufacturing Park
kW	Kilowatt (unit of power)
kWh	Kilowatt hour (unit of energy)
kWh_{th}/y	Kilowatt hour (of unit of thermal energy) per year
LDF	Local Development Framework
LPA	Local Planning Authority
MEP	Mechanical, Electrical, Plumbing (as in MEP cupboard for domestic utilities)
MEV	Mechanical Extract Ventilation
MHCLG	Ministry of Housing, Communities & Local Government
MMC	Modern Methods of Construction
MVHR	Mechanical Ventilation with Heat Recovery
PPA	Power Purchase Agreement
PV	Solar Photovoltaic
SAP	Standard Assessment Procedure (to model domestic energy consumption)

SAP 10	Emerging Standard Assessment Procedure (for use with Part L 2021)
SAP 2012	Existing Standard Assessment Procedure (for use with Part L 2013)
SBEM	Simplified Building Energy Model (to model commercial energy consumption)
SPD	Supplementary Planning Document
tCO_2/y	Tonnes of Carbon Dioxide per year
TER	Target Emission Rate
TFEE	Target Fabric Energy Efficiency
TPER	Target Primary Energy Rate
WA	Wardell Armstrong
WWHR	Waste Water Heat Recovery

1 INTRODUCTION

1.1 Overview

1.1.1 The application is submitted by Envision AESC UK Ltd (the Applicant). The Site is part of the International Advanced Manufacturing Park (IAMP), which is a joint venture between Sunderland and South Tyneside Councils with Henry Boot Developments. The Site itself lies within the administrative area of Sunderland Metropolitan Borough Council.

1.1.2 Wardell Armstrong has been appointed to produce this energy statement setting out the energy strategy for the proposed development.

1.2 The Application

1.2.1 The 2020 planning application (ref. no. 20/00556/OU4) sought outline planning permission for: *"…the erection of industrial units (up to 98,937.2 m^2) (gross internal area) for light industrial, general industrial and storage and distribution uses (Class B1(c), B2 and B8) with ancillary office and research and development floorspace (Class B1(a) and B1(b)) with internal accesses, parking, service yards, electricity sub-stations, attenuation basins and associated infrastructure, earthworks and landscaping, as well as the demolition of the existing buildings at West Moor Farm*." All matters were reserved for determination at a later stage. Access was reserved for future approval as the precise location of access routes into / within the Site were unknown at the time of writing and submission. Access to the Site was to be from the A1290 via International Drive.

1.2.2 Within the 2020 ES, Figure 3.1B Indicative Masterplan Option B illustrated the development of the Site with one industrial unit (orientated south-west to north-east), and the 2020 application was granted planning consent in June 2020.

1.2.3 Subsequent to receiving planning consent, an amendment to the following were proposed; thereby necessitating the submission of a new application comprising:

- Small changes to the redline boundary (e.g. along the southern perimeter, and changes to accommodate the access road junction) resulting in a small reduction of the Site area.
- A change to the position and orientation of the industrial unit.
- A change of use (still within Class B2) to operations associated with an electrode and battery manufacturing facility, including the storage and use of hazardous substances.

1.2.4 The proposed development consists of a single, three-storey industrial unit (Class B2 General Industrial) that is to house an electrode and battery manufacturing facility with a maximum capacity of up to 9 GWh / annum, comprising of two battery manufacturing plants separated by a central spine of offices. Included within the unit will be an integral electrode manufacturing plant.

1.2.5 The facility will employ circa 1,000 staff consisting of circa 850 shift-based staff and circa 150 day-based (office) staff. Access to the Site will be from the A1290 via International Drive and an 800-space staff carpark will be created to the immediate north of the unit that will include 40 7 kWh electric vehicle charging bays.

1.2.6 The proposed facility will manufacture lithium-ion battery pouch cells and modules for electric vehicle (and other applications) via four production areas comprising of: electrode manufacture; cell production; formation and testing; and module assembly.

Figure 1.1: Envision AESC UK Battery Plant – Site Location

(Extract of Site Location Plan produced by RPS)

1.2.7 The redline development boundary demarcating the Site (see Figure 1.1, above) covers parts of seven distinct agricultural fields and one farm complex, with mature trees demarcating some of the field boundaries.

1.2.8 Figure 1.2, below, shows the plan of the proposed building.

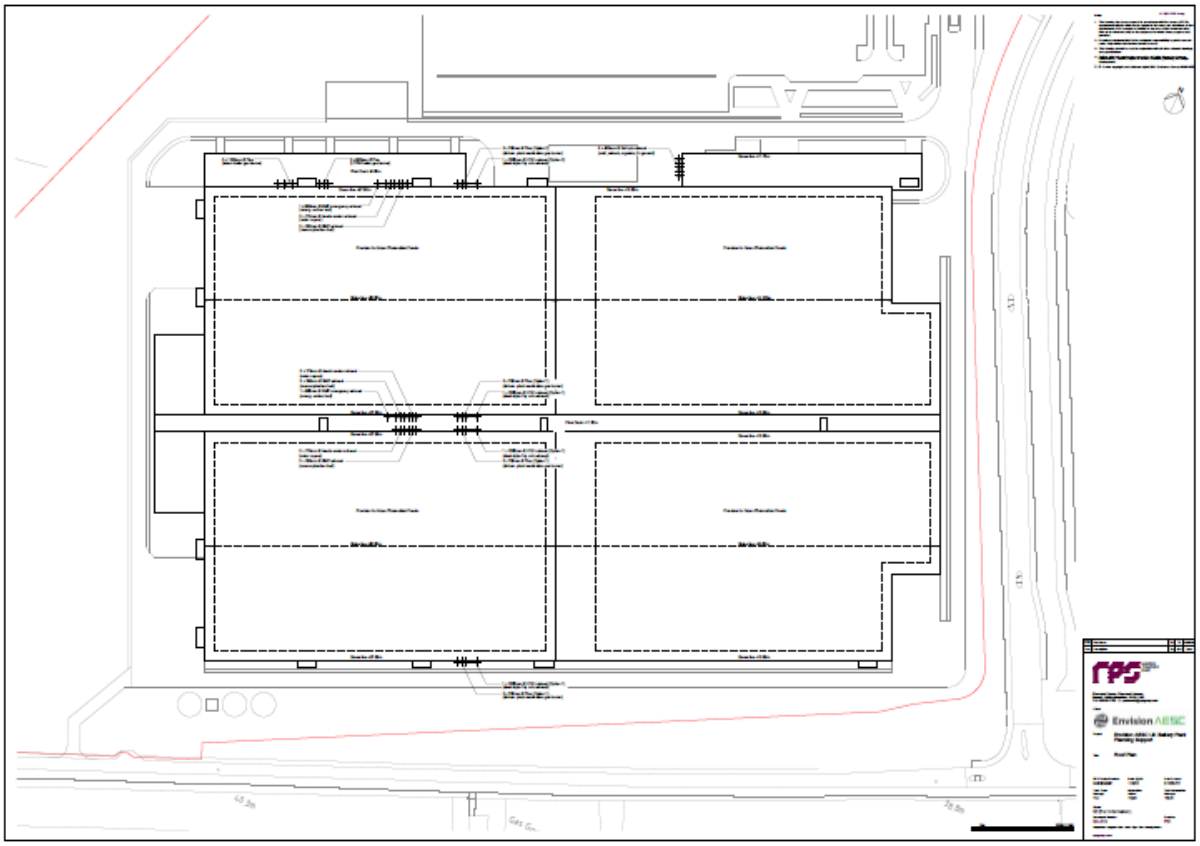

Figure 1.2: Envision AESC UK Battery Plant – Roof Plan

(Extract of Site Roof Plan produced by RPS)

1.2.9 Over recent years there has been limited incentive for developers to improve on the building performance beyond the minimum levels established by building regulations. Some Local Authorities have incorporated improved energy performance or carbon emissions reduction into their Local Plans but it is only in the last 12 months that Central Government has started pushing the zero-carbon agenda for the built environment.

1.2.10 The Future Buildings Consultation, as discussed below, has proposed that a significant 'interim' carbon reduction requirement of 27% will be introduced in 2021, with a much more ambitious target (still to be determined, although if it follows the trajectory of the residential target, 75-80%) from 2025.

1.2.11 Recognising that, subject to the necessary consents, the proposed development, will be built out prior to 2025, the emissions reduction target that Envision will seek to meet is 27%.

2 POLICY AND REGULATION

2.1 National Policy and Regulation

2.1.1 At the national level, principal planning policy is provided by the National Planning Policy Framework and the Planning Practice Guidance. Building Regulations are part of the building control process and ensure appropriate minimum standards of build are maintained across the nation. Further detail is provided below.

2.2 National Planning Policy Framework (NPPF)

2.2.1 The National Planning Policy Framework (the 'NPPF' or 'the Framework') was first published in March 2012. The Framework replaced the majority of existing Planning Policy Statements (except for a small number of documents, including Planning Policy Statement 10: Planning for Sustainable Waste Management, the Companion Guide to Planning Policy Statement 22: Renewable Energy (which was subsequently superseded by the 'Planning Practice Guidance for renewable and low carbon energy' document published in July 2013) and the PPS5: Planning for the Historic Environment Practice Guide).

2.2.2 The Framework is a material consideration that must be taken into account in the determination of planning applications.

2.2.3 The Framework was updated in June 2019 and then, again, in July 2021 and, along with the aforementioned Planning Practice Guidance, forms the main body of national planning policy in the UK.

2.2.4 Annex 1 of the new NPPF document clearly states that "*existing policies should not be considered out-of-date simply because they were adopted or made prior to the publication of this Framework. Due weight should be given to them, according to their degree of consistency with this Framework*".

2.2.5 References to 'NPPF' or 'the Framework' hereafter shall be in relation to the revised documents.

2.2.6 The cornerstone of the Framework is the "*presumption in favour of sustainable development*" (paragraph 11) to ensure that sustainable development is pursued in a positive way.

2.2.7 This means that local authorities should generally seek to approve development proposals that accord with the development plan without delay and, where the relevant plan is silent or out of date, grant planning permission unless it would give

rise to adverse impacts which would significantly and demonstrably outweigh the benefits, when assessed against the Framework as a whole. Development which is sustainable should proceed.

2.2.8 Chapter 14 of the NPPF, 'Meeting the challenge of climate change, flooding and coastal change', notes several relevant points. Firstly, paragraph 152 states that "*the planning system should support the transition to a low carbon future in a changing climate… It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience... and support renewable and low carbon energy and associated infrastructure*."

2.2.9 Additionally, "*new development should be planned for in ways that… can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards*" (paragraph 154).

2.2.10 Paragraph 155 states that development plans should "*identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers*."

2.2.11 Paragraph 157 also notes new development must "*comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this not feasible or viable; and take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption*."

2.3 Local Policy

2.3.1 Policy BH2 from the Sunderland Core Strategy and development plan states that:

Policy BH2 Sustainable design and construction

Sustainable design and construction should be integral to development. Where possible, major development (as defined in the 2021 Framework) should:

1. *maximise energy efficiency and integrate the use of renewable and low carbon energy;*
2. *reduce waste and promote recycling during construction and in operation;*
3. *conserve water resources and minimise vulnerability to flooding;*
4. *provide details of the type of materials to be used at the appropriate stage of development;*

5. *provide flexibility and adaptability, where appropriate, allowing future modification of use or layout, facilitating future refurbishment and retrofitting;*
6. *include opportunities to incorporate measures which enhance the biodiversity value of development, such as green roofs;*
7. *include a sustainability statement setting out how the development incorporates sustainable resource management and high environmental standards; and*
8. *maintain an appropriate buffer between sensitive development and existing waste water treatment works to ensure amenity and operational continuity, in accordance with Government Code of Practice guidance.*

2.3.2 Policy WWE1 goes on to state:

Policy WWE1 Decentralised, renewable and low carbon energy

1. *The development of decentralised, renewable and low carbon energy will be supported subject to satisfactory resolution of all site specific constraints as follows:*
   i. *decentralised, renewable and low-carbon energy development should be located and designed to avoid unacceptable significant adverse impacts on landscape, wildlife, heritage assets and amenity;*
   ii. *appropriate steps should be taken to mitigate any unacceptable significant adverse impacts, such as noise nuisance, flood risk, shadow flicker, interference with telecommunications, air traffic operations, radar and air navigational installations through careful consideration of location, scale, design and other measures; and*
   iii. *any adverse cumulative impacts of proposals.*
2. *Development that can provide combined heat and power must demonstrate that due consideration has been given to the provision of any heat produced as an energy source to any suitable adjacent potential heat customers.*

2.3.3 There is also specific energy related policy included within the '*International Advanced Manufacturing Park Area Action Plan 2017-2032 Adopted Nov-2017*', as follows:

Policy IN1: Infrastructure Provision

In demonstrating comprehensive development under policies S1 and Del2, development proposals must show how the following infrastructure will be delivered:

i. a new electricity sub-station may be required as part of the comprehensive development of the IAMP to ensure there is sufficient energy to meet the demands of businesses locating at the IAMP.

ii. new water, gas and electric utility services must be made available to the IAMP development site from the existing utilities infrastructure in the local vicinity to enable occupiers to apply for, and obtain, utility connections to their premises. This may require connections to be made with utilities infrastructure outside of the AAP boundary.

iii. new telecommunications and broadband services networks must be provided to allow occupiers to apply for, and obtain, telecommunication connections to their premises as required.

iv. the provision of low carbon and renewable energy systems should be explored.

2.3.4 Policy clearly recognises that the IAMP will require considerable energy provision whilst at the same time supporting the use of low carbon and renewable energy generation to help meet this demand.

2.4 Legislative Requirements

Building Regulations

2.4.1 Part L of the Buildings Regulations state that new buildings must achieve both a 'Target Emission Rate' (TER) and a 'Target Fabric Energy Efficiency' (TFEE) rate. For residential properties both the TER and TFEE must be calculated using methods set out in 'Standard Assessment Procedure' (SAP), 2012. The equivalent calculation which is more relevant for this project is that carried out for non-residential property using the 'Simplified Building Energy Model' (SBEM).

2.4.2 The TFEE is derived from Fabric Energy Efficiency Standards (FEES) developed by the Zero Carbon Hub which are a measure of the amount of energy required to maintain a building at a comfortable temperature. The TFEE rate is an overall value measured in kWh/m2/yr which is affected by:

- Building fabric U-values;
- Thermal Bridging;
- Thermal Mass; and
- Features effecting lighting and solar gains.

2.4.3 Various combinations of fabric efficiency measures may be employed to meet the TFEE limit. There are also limiting standards for the properties of the fabric elements of the dwelling, although the buildings specification needs to be considerably better than the limiting values to meet the TER. The TER is calculated using a notional building of the same size and shape as the actual building but with specific building fabric properties. If a building is built out using the exact specifications of the notional building, it will just achieve the TER and fabric energy efficiency requirements.

2.4.4 On 19 January 2021, the Government published a new consultation on 'Future Building Standards' (FBS). The FBS is aimed at provoking decarbonisation in new non-residential and existing residential buildings. As part of the FBS, the Government is consulting on a preferred 27% reduction relative to Part L 2013 levels for non-residential buildings for the interim period, to facilitate the eventual realisation of zero-carbon buildings.

2.4.5 It is intended (subject to the FBS consultation) that a new Part L 2021 (and Part F 2021) will be introduced towards the end of this year and come into effect during 2022. This will formally instigate the interim arrangements for both residential and non-residential developments. Buildings approved prior to June 2022 and commenced prior to June 2023 will remain eligible to be built out under Part L 2013, but this will only apply to individual units and not a site in its entirety.

2.4.6 The consultation response also confirmed the Government's intention that Part L 2021 will apply the 31% emission reduction target over Part L 2013 for residential development.

2.4.7 The FBS consultation concluded in April 2021 and the Government is currently reviewing the responses before issuing its updated position.

2.4.8 The FBS is intended to complement the Future Homes Standard (FHS) which was established through a similar consultation process which took place a year earlier. The FBS (for commercial property) and the FHS (for residential property) are intended to be the mechanisms by which the Government will stimulate much greater energy efficiency within the built environment and ultimately ensure that the building industry is on track to help meet the legally binding Climate targets. Both Standards are intended to be introduced in to law this year and come into full effect in mid-2022.

EV Charging

2.4.9 In July 2019 the Government ran a consultation on electric charging requirements for

new buildings entitled 'Electric Vehicle Charging in Residential and Non-Residential Buildings', which included '*Section 2: Buildings other than Dwellings*' Whilst this consultation closed and so far no further action has been taken, it is anticipated that the proposed changes (or something similar to the proposed changes) will be brought into effect at some point in the near future through a Part S addition to Building Regulations.

2.4.10 The consultation proposed a requirement for every new non-residential building "*with more than 10 car parking spaces to have one chargepoint and cable routes for an electric vehicle chargepoint for one in five spaces*"[1].

[1] HM Government Consultation Paper, "*Electric Vehicle Charging in Residential and Non-Residential Buildings*", July 2019.

3 ENERGY REQUIREMENTS

3.1 Construction

3.1.1 Given the scale of the development the construction process will inevitably require a considerable amounts of materials to build and will use a significant amount of energy to complete the necessary works.

3.1.2 Some elements of the detailed design process remain to be finalised but estimates of the construction energy requirements have be made to help inform the energy statement.

3.1.3 During construction different vehicles and equipment will be used to transport materials around Site to the point of use and for installation. Breakdowns of expected fuel requirements have been provided by the contractors bidding to build out the development and these have been used to help estimate overall fuel requirements. It should be noted that these figures are approximate at this stage and further logistical optimisation, scheduling improvements and other efficiency savings could alter these figures.

3.1.4 It is estimated that 716,300litres of fuel would be required on site during construction for the operation of cranes, excavators, forklifts, screeders, bull dozers, rollers, dump trucks etc. These would breakdown roughly as below:

Table 3.1: Estimation of Onsite Construction Fuel Use

Work Element	Estimated Gas Oil Fuel Use (Litres)
Steel frame/secondary steel	159,432
Concrete	15,600
Bulk Excavation & Fill	104,832
Ground Works	210,080
Piling	21,216
Roof & Cladding	77,636
M&E Operations	15,392
Other	112,112
Total	**716,300**

3.1.5 This quantity of fuel is equivalent to approximately 7,694,495kWh of energy (Gross CV).

3.1.6 It is also estimated that circa 937,500kWh of imported electrical energy will be

required during the construction phase to operate various pumps, tools, and other items of equipment.

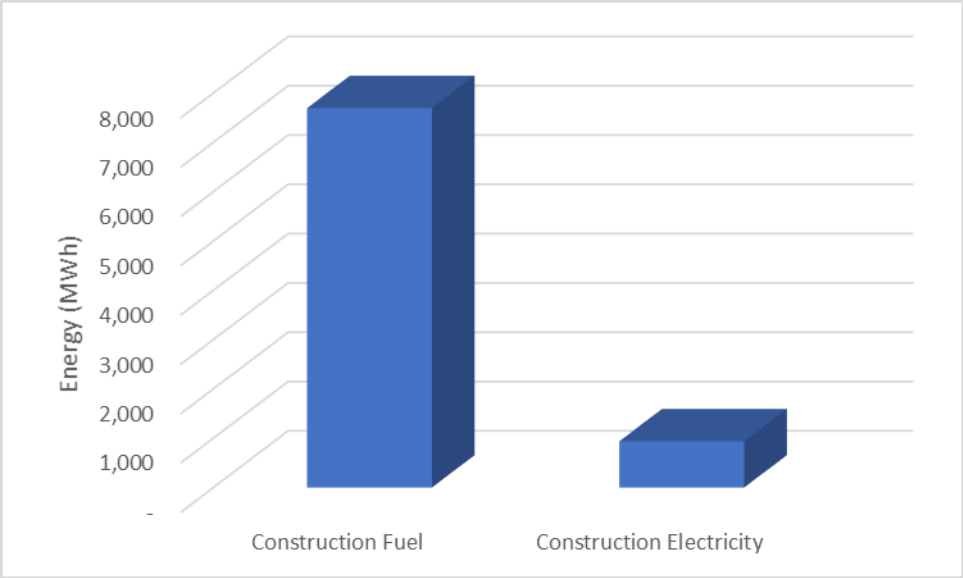

Figure 3.1: Estimated Energy Use During Construction

3.2 Operation

3.2.1 The proposed facility will manufacture lithium-ion battery pouch cells and modules for electric vehicle (and other applications) via four production areas comprising of: electrode manufacture; cell production; formation and testing; and module assembly.

3.2.2 A number of these processes are highly energy intensive and require substantial amounts of heat and power.

3.2.3 Although detailed design for the building is well progressed, there is still currently a degree of flexibility in the specification of plant that will supply the heat and power, which will only be determined fully once planning consent is obtained and the principal contractors are formally appointed. To that end there is a degree of uncertainty regarding whether gas boilers or electric alternatives will be used to supply the plant.

3.2.4 For the purpose of this assessment two scenarios have been considered. One (Scenario A) which assumes the heat will be generated by gas boilers and a second (Scenario B), which assumes an all-electric configuration.

Common Electrical Requirements

3.2.5 In both scenarios, there would be common elements that would require electrical energy supply, regardless of the other heating sources. These are summarised in Table

3.2 below.

Table 3.2: Electrical Requirements Common to both Scenarios		
Work Element	**Estimated Max Demand (kVA)**	**Estimated Energy Use (MWh/yr)**
Building Services	tbc	51,754
Utilities (excluding EV Chargers)	4,205	36,863
Electrode Plant	5,044	32,181
Cell (Area A)	2,488	15,873
Cell (Area B)	2,575	16,429
Module (Area C)	405	2,584
Chillers	5,000	15,950
EV Chargers (Car Park)	384	1,617
Total		**173,223**

3.2.6 The 'building services' category in the table above represents regulated energy use within the development. That is energy relating to space-heating, hot water, lighting, pumps and fans and that would be controlled by Building Regulations. Figures provided are estimated but detailed SBEM assessment will be prepared once detailed designs have been finalised.

Scenario A

3.2.7 Scenario A allows for the inclusion of low temperature hot water (LTHW) gas boilers, high temperature hot water (HTHW) boilers (steam plant), and gas-powered dehumidifiers.

3.2.8 The Babcock Wanson HW3P Hot Water Boiler is a full 3-pass fired heater designed for operation with Natural Gas (as shown in Figure 3.2). For planning purposes, it is assumed that there would be five of the HW3P 2510 units required, each rated at 2.5MW$_{th}$, providing a total rated capacity of 12.5MW$_{th}$. These boilers would be utilised 24hours a day, seven days a week across the operating period of the plant. This is assumed to be 48weeks of the year. In reality, loading of the boilers will fluctuate during usage but, based on experience of plant operations in other Envision facilities, the loading is likely to be 80-90%. For a worst-case scenario analysis, 100% loading has been assumed.

3.2.9 The predicted fuel requirements to sustain this operation are 109,276MWh of gas.

Figure 3.2: NW3P Series Boilers from Babcock Wanson

3.2.10 The steam plant is expected to comprise three BWR 150A boilers. The boilers will be operated so that only two boilers are duty boilers at any one time, with the third being a standby reserve boiler, in case of contingency requirements.

Figure 3.3: BWR Series Steam plant from Babcock Wanson

3.2.11 Similar to the LTHW boilers, utilisation and loading of the two duty boilers has been assumed to be 100% to represent a worst-case scenario. In this case the 20MW$_{th}$ boilers are expected to require 159,272MWh worth of gas to cover the same 48week operational period.

3.2.12 The dehumidifier plant comprises a large rotating desiccant rotor which absorbs moisture from input 'wet air' that's fed into the plant, as shown in the image below (lower duct). The 'dry air' is then routed to the cleanroom environment. As the rotor rotates past the reactivation sector (upper duct shown below), hot air is driven through the desiccant rotor to dry it out. The hot air is generated through a natural gas burner and an air to air heat exchanger.

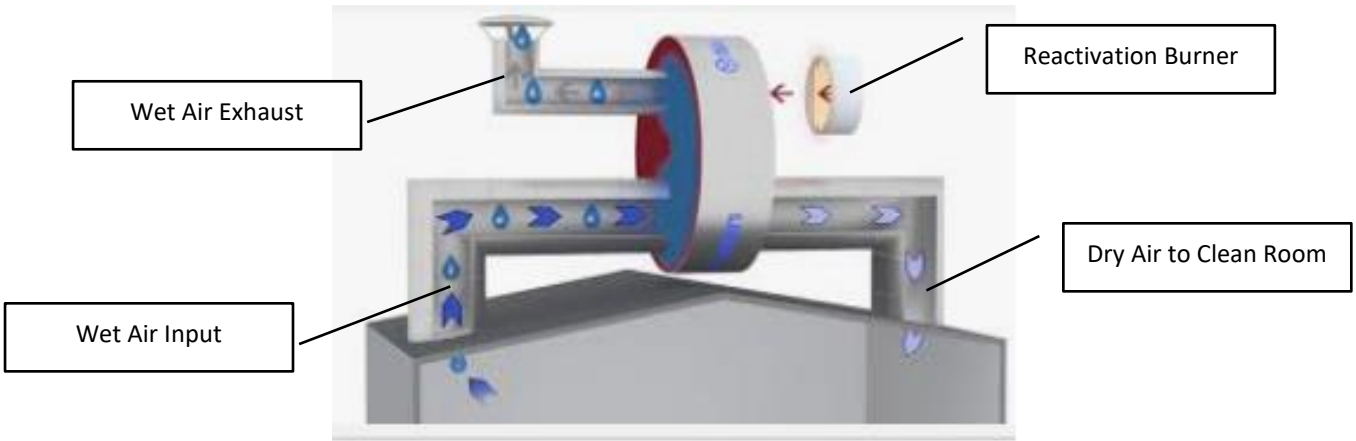

Figure 3.4: Dehumidifier Process

3.2.13 The specifications of the dehumidifier plant remain to be determined, but based on previous experience, the plant is expected to consume approximately 119,605MWh of gas.

3.2.14 Even with the gas boilers, steam plant and dehumidifiers, there will still be a requirement for substantial amount of imported electrical energy.

Scenario B

3.2.15 Scenario B allows for the inclusion of electric heating. In this scenario the LTHW gas boilers and the steam plant would be replaced by equivalent electrical plant. Similarly, an electrical heating element would heat the air used to drive moisture from the desiccant rotor in the dehumidifiers. Although obtaining suitable electrical plant to meet these requirements is considerably more challenging, the big advantage with

electrical power is that it can be decarbonised much more readily by changing to a low carbon source of generation.

Table 3.3: Additional Electrical Requirements Under Scenario B		
Work Element	**Estimated Max Demand (kVA)**	**Estimated Energy Use (MWh/yr)**
Electric Boilers	12,500	106,105
Coater Dryer Electric Dryer	20,000	129,024
Dehum Plant Electrical Dryer	14,832	59,803
Total		**294,932**

Comparison of Scenario's A & B

3.2.16 The all-electric option appears to show a considerable energy saving over the energy required to operate the gas-fed equivalent heating systems. The annual energy saving from switching to electricity is estimated to be circa 0.3% (see Figure 3.5). It should be noted that there are a number of assumptions that have been used to arrive at this figure and detailed system design for the all-electric approach is not currently available. Consequently, the level of energy saving must be caveated to recognise this uncertainty.

Figure 3.5: Annual Energy Use for Each Scenario

3.2.17 Although the amount of energy required for the process is almost identical in both scenarios, there will inevitably be a substantial carbon emission saving over the lifetime of the project derived from the rate of electrical grid decarbonisation relative to fairly constant levels of gas emissions.

3.2.18 No modelling has been undertaken to account for potential decarbonisation of the gas grid although it is possible that biogas or hydrogen injection into the gas main will have

a decarbonising effect. However, this is unlikely to be capable of fully decarbonising the network without substantial improvements to the gas gird infrastructure.

3.3 Decommissioning

3.3.1 The project lifetime is estimated to be 60years. The decommissioning process is anticipated to be more-or-less the exact reverse of the construction process in that site materials will be disaggregated as far as possible and removed from site to a future use or, if no further reuse is possible, to a suitable disposal facility.

3.3.2 Since decommissioning will not occur until the end of the life of the project, the techniques used in deconstruction, material reclamation, and recycling are likely to have considerably improved by then. It is difficult to project what energy requirements will be by this time.

3.3.3 For the purpose of this assessment, it is simply assumed that the total energy used in decommissioning will be broadly similar in quantum to the energy used in construction. This is considered to reflect a worst-case scenario.

Table 3.4: Projected Decommissioning Energy

Energy Source	Estimated Energy Use (kWh)
Estimate of Gas Oil Use	7,694,495
Estimate of Electrical Energy Use	93,750

4 BEING LEAN

4.1 Introduction

4.1.1 The first element of the Energy Hierarchy is 'Be Lean'. This encompasses measures intended to reduce emissions that are inherent in a building's design, specification and construction. It also includes other energy efficiency measures that can be incorporated into the day to day operation of a building, such as the use of energy efficient lightbulbs.

4.2 Modern Methods of Construction

4.2.1 Modern Methods of Construction (MMC) are important as they assist with improving construction efficiency and overall performance whilst reducing material wastage.

4.2.2 The term modern methods of construction (or 'smart construction') is used to describe a set of building techniques centred around the offsite production of panels which can be easily assembled onsite.

4.2.3 Where possible, any components of the development that can be constructed offsite under factory conditions rather than onsite in a less controlled environment, will be put together in this way and transported to site for assembly. This will ensure that wastage is minimised, specialist assembly workers are used and an improved standard of construction efficiency is achieved.

4.3 Whole Life Cycle Emissions

4.3.1 It is important to consider the whole life cycle of buildings and provide a mechanism to ensure that consideration has been given as to how materials used in construction will be recycled at the end of their life.

4.3.2 It is not proposed to undertake fully detailed lifecycle analysis of every component used in the construction as this would be excessive but embedded emissions associated with bulk components will be calculated and recorded.

4.3.3 There is limited opportunity in this industrial setting but maximising the use of materials such as timber, which tend to have much lower embodied energy content than man-made products such as concrete and steel, will help to minimise the carbon associated with the production of the construction materials.

4.3.4 Operational emissions associated with onsite energy use over the lifetime of the project will be calculated based on predicted regulated and unregulated energy demand. At the time of undertaking this assessment SBEM Assessments are not

available for the buildings and these will be completed once the contractor has fully specified the detailed design. The figures contained in the energy statement for regulated energy use (that is energy use associated with building services rather than process energy) are therefore considered to be best estimates available at this stage. The 'as built' SBEM worksheets that will be required for Building Control sign off will be much more comprehensive and accurate but are expected to reflect similar regulated energy use.

4.3.5 It is expected that the proposed development will adopt a 'Design for Deconstruction' approach. This is essentially a methodology for recording the materials used in construction, grouping them into the following categories:

- foundations and ground floor;
- other floors;
- roof;
- external walls;
- other walls and finishes;
- floor finishes;
- building services and sanitary ware; and
- fixtures and fittings

4.3.6 Materials can then be weighted according to their embodied carbon, and scored based on their reuse potential or recyclability, connections between elements and components, accessibility, and the deconstruction process. This information will be documented to aide improved sustainability and resource efficiency at the time of decommissioning.

4.3.7 The information generated during the design and construction process can then be recorded in the Building Information Modelling (BIM) system for future reference and management.

4.4 Optimising orientation and site layout

4.4.1 Given the existing constraints imposed by the site location and surrounding environment, and the nature and purpose of the building itself, the design has been developed as best as possible to meet design criteria for overheating and cooling. Consequently, it has aimed to strike a balance between enabling sufficient daylight to be received throughout the year, taking advantage of solar gains during the winter

and avoiding excessive heat gains during the summer. Achieving this will reduce requirements for artificial lighting and active heating and cooling thereby minimising emissions.

4.5 Solar Shading

4.5.1 There is limited ability to provide natural solar shading on site. Wherever possible, the proposed development will retain existing mature trees particularly around its perimeter but at various locations within the wider site too. These may provide a small amount of solar shading to ground floor areas, aiding their ability to avoid overheating during summer.

4.6 Natural Ventilation

4.6.1 Due to the industrial nature of the activities inside, the main building will have very few windows. The smaller office block does have windows and, where possible, natural ventilation will be promoted through the provision of opening windows. Natural ventilation can be increased in rooms that incorporate dual-aspect opening windows, which can help provide natural cross ventilation.

4.7 Energy Efficient Building Fabrics

4.7.1 The thermal performance of building fabrics is a key part of energy efficiency. A material's thermal transmittance is expressed in its U-value which describes the rate of heat transfer through that material per unit temperature difference. High performance materials will have a low U-value. The precise building fabrics have yet to be confirmed and this will obviously heavily influence the appropriate U-values.

4.7.2 In the absence of detailed SBEM assessments at this stage, emission reductions in the regulated energy use within the buildings have been assumed based on the working assumptions for the design criteria. Provision of the detailed SBEM assessments for each building will be required in order to comply with Part L of The Building Regulations, and this will be completed post-planning, once the relevant contractors have been appointed and finalised designs.

4.8 Air Permeability

4.8.1 The air tightness of the buildings has yet to be confirmed. If possible, it is recommended that the air tightness be designed to be 4.0 $m^3/m^2/hr$ at 50Pa. This is a suitable air tightness to accommodate the Mechanical Extract Ventilation (MEV) system that is proposed. Increasing air tightness beyond this level will improve energy

efficiency but risks having a detrimental impact on air quality. In that case Mechanical Ventilation with Heat Recovery (MVHR) should be considered.

4.9 Glazing

4.9.1 The main building has limited windows. The proposed specification for the glazing in the office block is still to be determined. Where possible windows will be opening, with suitable restrictors for safety and security, to prevent risk of overheating.

4.10 Waste-Water Heat Recovery (WWHR)

4.10.1 A wastewater heat recovery system is designed to extract useful heat from wastewater that would otherwise flow straight down the drain. The wastewater heats incoming water to reducing the strain on the boiler and minimising the energy used. WWHR systems will be considered for use within the proposed development where there are suitable facilities to accommodate them, although no commitment is currently made that this approach will be adopted.

4.11 Lighting and Appliances

4.11.1 All rooms in the buildings will incorporate 100% low energy lighting. This will reduce the energy required to light the buildings, thereby reducing emissions as well as aiding overheating provision by reducing additional sources of heat from the development. Communal areas such as corridors, stairwells and external lighting will be energy efficient in design as well. As a further energy saving measure, where appropriate, movement sensors will be installed to switch off the lights during prolonged periods of inactivity.

5 BE CLEAN: SUPPLY ENERGY EFFICIENTLY

5.1 Introduction

5.1.1 The 'Be Clean' element of the energy hierarchy is intended to examine the potential contribution of district heating and CHP to the energy strategy for the development.

5.1 District Heating Network (DHN)

5.1.1 District heating uses centralised heat sources that then provide heating throughout a network of connected buildings, which is available via pre-insulated pipes.

5.1.2 District heating is widely championed due to perceived efficiency gains from operating a centralised energy centre, however, its inherent advantages are not always clear. If there is a large source of waste heat onsite that can be captured and delivered to a network to provide useful heating then it is most likely to be feasible.

5.1.3 There is considerable cost associated with the installation of such a network and, although highly insulated pipes are used to deliver the heat, there will be network losses and pumping losses associated with delivering the heat to individual properties. There are also some losses associated with Heat Interface Units (HIU) or heat exchangers.

5.1.4 District Heating becomes a more viable option where there are significant anchor loads such as universities or hospitals or where there is a high density of housing, particularly high-rise accommodation. Whilst IAMP would potentially be a suitable anchor load for a heat network, the fact that such a network does not already exist and would be subject to a separate consenting process and third-party ownership and delivery is too great a risk to the project.

5.1.5 It is understood that Sunderland City Council are aiming to deliver a large district heat network within the city using heat from the former Wearmouth Colliery. This is still at an early stage of development with a decision on whether or not to proceed not expected until late-2022, with construction, if progressed, coming a year or two later. With the heat source lying over 5km away from the Site as the crow flies, the timeline for delivery not being suited to supplying the IAMP One Phase Two facility, and the risk involved in whether or not the project actually progresses, this is not a realistic option for heat supply.

5.1.6 It is also not viable for the plant to setup its own district heating facility to supply heat offsite. All heat generated onsite will be used by the processes onsite, so there will be

no surplus available for export.

5.2 Combined Heat and Power (CHP)

5.2.1 Combined Heat and Power (gas CHP) systems offer the combined onsite generation of heat and electricity using natural gas as the fuel source. Biomass CHP systems have been excluded from the analysis due to potential air quality concerns and the increasing cost of biomass fuel supply.

5.2.2 CHP systems require less fuel to produce a given amount of energy compared with separate production and import of heat and electricity through onsite gas boilers and the national grid respectively. Therefore, where both heat and power are required, CHP is a more efficient process and subsequently has potential to offer carbon savings. It should be noted that incremental increases in gas boiler efficiency, which on modern systems can already operate with an efficiency of over 90%, and the ongoing decarbonisation of grid electricity are steadily eroding some of these advantages.

5.2.3 CHP systems are suited to installations where a constant heat and electricity load exist in a relatively fixed ratio. CHP systems are typically sized to handle the base load; energy output is such that they can run for extended periods to meet a minimum energy demand. Gas boilers are more flexible and can be ramped up quickly, thus they are typically used to handle peak load demands with grid electricity import.

5.2.4 Gas CHP may be a suitable technology for this Site, but it has not been considered in detail at this stage. In line with the climate objectives of the company, the aim will be to fully electrify all operations, if at all possible. This, coupled with renewable generation and grid decarbonisation should help deliver a zero carbon solution. Gas boilers are the current fall-back position in case this is not possible and gas CHP will also be considered, should that situation arise, however the strong preference would be to move away from using gas on site at all.

6 BE GREEN: RENEWABLE ENERGY TECHNOLOGIES

6.1 Introduction

6.1.1 A key part of the Energy Hierarchy is consideration of how to best incorporate renewable technologies into proposed developments.

6.1.2 A number of technologies have been summarily scoped out of further study, as discussed below, based on obvious limitations to their viability in this location. Several other renewable and low carbon energy options have been considered in slightly more detail to determine their suitability for meeting the renewable energy target at the site.

6.2 Hydropower

6.2.1 There are no suitable rivers or watercourses in close enough proximity to the site to make hydropower an appropriate option in this location.

6.3 Windpower

6.3.1 Roof-mounted wind turbines could be a viable option in the future, however research suggests that these often do not perform that well, producing relatively low levels of energy, especially in low wind speed locations. Micro wind turbines would be a relatively expensive by comparison to other technologies and have the potential to cause noise and vibration issues. They have therefore not been considered further.

6.3.2 It would be challenging to accommodate larger wind turbines onsite, especially given potential future development within the International Advanced Manufacturing Park. Wind turbines may be subject to additional restrictions in relation to noise emissions. Consideration would also need to be given as to whether the turbines would be exposed to turbulent wind flow as approaching winds would need to traverse numerous buildings including the Gigafactory itself and any neighbouring units. Depending on the degree of turbulence, this could render the wind turbines unfeasible.

6.3.3 Despite the limitations, the Applicant is keen to explore wind energy as a potential future opportunity following direction from the company Managing Director, who has voiced his support that all Envision plants around the world should consider options for integrating wind generation wherever possible and feasible to do so. Whilst it does not form part of this application, further work will be undertaken in the future to see if a suitable site nearby can be identified for potential future development.

6.4 Biomass Heating

6.4.1 Given the potential for air quality issues, and the direction of emerging planning policy, such as contained in the New London Plan (not relevant to this location but still reflective of current thinking), biomass heating is not expected to be acceptable for this development. Furthermore, delivery, onsite storage space and biomass fuel loading requirements would be likely to further constrain this technology in this location.

6.5 Anaerobic Digestion (AD)

6.5.1 Anaerobic digestion technology is relatively mature but requires space to be available to store the biofuel feedstock and process waste materials.

6.5.2 Microscale plants are being developed and there may be some potential to consider these as part of an onsite waste treatment facility for the brown and black waste streams from the Proposed Development in the future but at present the existing Sunderland sewerage system is a more viable solution to the expected volume of waste being generated on site. Even given the size of the plant being developed, the circa 1200 staff would only generate a relatively small amount of food and sewage waste, so to be viable an AD would likely need to import waste and/or energy crops from elsewhere to provide sufficient food-stock.

6.5.3 Whilst AD would no doubt be a good way of disposing of waste, it would detract from the core operations of the business and may be something that would be better progressed by a dedicated third party offsite.

6.5.4 If waste were to be collected, in order to remain useful, it would need to have a carefully managed moisture content. Rather than traditional flushing toilets the plant would likely require vacuum toilets to minimise the water effluent involved. High water content reduces the efficiency of AD systems. Whilst this may be technically possible it would be difficult to justify within the business model for the development as currently being progressed.

6.6 Ground-Mounted Solar Photovoltaics (PV)

6.6.1 Ground space is at a premium and there is insufficient room or cost-benefit to accommodate a ground-mounted solar PV array in close proximity to the site. Even if this were not the case, overshadowing from adjacent buildings (existing and proposed) and mature trees would likely to prevent efficient operation of the solar

arrays. Consequently, no further consideration has been given to ground-mounted arrays, although roof mounted arrays are considered in more detail below.

6.7 Solar Thermal Systems

6.7.1 Solar thermal systems can provide hot water for a building. A collector connected to a cylinder by a riser to the roof is a typical installation. Any hot water demand not satisfied by the solar hot water system can be met using electric immersion heaters or conventional gas boilers.

6.7.2 Solar thermal collectors would need to operate alongside a primary heating system rather than directly replacing it. The most common arrangement involves solar thermal collectors being used to pre-heat a thermal store, with the primary heating system being used to ensure the supply temperature is reached.

6.7.3 Solar thermal collectors are efficient at converting solar insolation into heat but the expected demand associated with the development means that it would be likely to only provide a contribution and would struggle to meet full demand, especially during peaks.

6.7.4 Solar thermal collectors would require roof-top installation which would further conflict with other proposed roof uses, including a solar PV system strategy.

6.7.5 Solar thermal technologies perform best during times when the solar insolation is strongest. Although there is expected to be a baseload hot water demand within the Development throughout the year, demand for space heating in particular will be reduced/non-existent at the very time when solar thermal collectors will be producing most heat i.e. in the summer.

6.7.6 For the above reasons solar thermal collectors have not been pursued in the energy strategy for this development.

6.8 Ground Source Heat Pumps (GSHPs)

6.8.1 GSHPs can be used to meet space heating requirements. They are generally suited to buildings which require low-level continuous heating, and which have good levels of fabric efficiency. GSHP systems can use horizontal trench-based (slinky) or vertical borehole-based ground loops, the latter being more expensive but requiring significantly less space. It is not considered to be particularly practical to operate a horizontal system at this location, where ground space is at a premium. Allocation of ground space for boreholes would also be restricted by the construction of the

buildings themselves.

6.8.2 The suitability of the geology in the vicinity of the Site has not been investigated in detail and neither has any requirement for an Environment Agency Permit but both of these pose potential obstacles to the use of GSHP within the Energy Strategy for this Development.

6.8.3 GSHP technology has not been excluded at this stage and will remain a candidate for providing space heating and hot water in the offices, alongside ASHPs.

6.9 Air Source Heat Pumps

6.9.1 Air Source Heat Pumps (ASHP) operate in a similar way to ground source heat pumps but do not have the same requirements for surface or sub-surface ground availability.

6.9.2 Instead of 'pumping' heat from the ground they extract low grade heat from the outside air around the development. The heat is absorbed into a refrigerant working fluid which is passed through a compressor allowing its temperature to be increased. The working fluid delivers its heat to the heating circuits before expanding and cooling ready to be circulated again.

Figure 6.1: Example of a Commercial Mitsubishi Ecodan ASHP
(https://library.mitsubishielectric.co.uk/pdf/book/CAHV-P500YB-PISheet#page-1-2)

6.9.3 Since the refrigeration cycle draws in heat from the surroundings, less input energy is required to achieve a set level of heating that would be the case for a conventional heating system. The ratio of input energy to heat energy obtained is referred to as the heat pump's co-efficient of performance (CoP).

6.9.4 The seasonal co-efficient of performance (SCoP) provides a more realistic indication of the energy efficiency of the system by taking account of seasonal variations in performance. In lower ambient air temperatures, an air source heat pump will need to work harder to absorb enough energy to reach a desired temperature and this will reduce the system efficiency overall.

6.9.5 In this instance the office blocks that are expected to be supplied by heat pumps are spread across two floors, each with a floor area of 2,412m^2. The predicted heat demand for the space heating and hot water is 326MWh/yr. If this heat demand was to be supplied by gas boilers with 90% efficiency, it would require 362MWh/yr of gas to be burnt. However, an ASHP, with a CoP of 3 would only require an electrical load of 109MWh/yr to provide the same amount of heat. Furthermore, and unlike a gas boiler, as the electricity grid decarbonises, so the emissions associated with providing this heat will tend to zero. Over the lifetime of the IAMP facility, the energy demand will remain much lower with ASHPs, but the emissions savings will be lower again.

6.9.6 Detailed design and specification of heat pump has not been carried out (indeed it has not been determined whether GSHPs or ASHPs would be preferred option) but an indicative heat pump module is shown in Figure 6.1, above.

6.10 Solar PV

6.10.1 Solar PV is now an established technology in the UK building market. There are a large number of solar PV manufacturers producing panels for the UK, including from Europe, America and China.

6.10.2 PV panels are made from collections of PV cells which, in turn, are made from layers of semi-conducting (usually silicon) material. When sunlight falls on to the cell it creates an electric field across the layers. The more intense the sunlight is, the more electricity is produced.

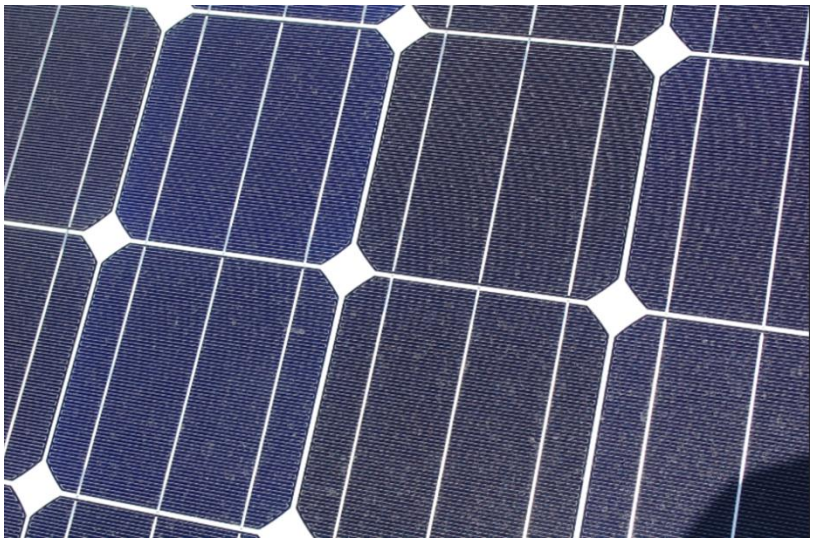

Figure 6.2: Solar PV Cells

6.10.3 The power of a PV cell is measured in watts peak (Wp), or kilowatts peak (kWp). This describes the rate at which it generates energy at peak performance under standard test conditions (STC) - cell temperature of 25°C, solar irradiance of 1000W/m^2, and air mass of AM1.5.

6.10.4 Each individual Solar PV panel will operate at optimum efficiency when deployed orientated towards the south. However, this does not preclude the use of panels on southwest or northwest facing-roofs, which will still generate a significant amount of power. Panels located on east-facing roofs will only generate in the morning while the sun is in the eastern sky, whereas west-facing panels will only catch the sun in the afternoon and evening as it passes over into the western sky. The pitch of the roof will also affect the efficiency of the panel, with an optimum south-facing pitch being about 35° at this latitude.

6.10.5 It is intended to install Solar PV panels on available rooftops across the whole of the site, as shown on the illustration below in Figure 6.3. An indicative coverage of 75% of roof space has been targeted, allowing for removal of some panels for reasons of shading.

6.10.6 To aid access for maintenance, gaps will be left between every two rows of panels. A standoff will also be left around the perimeter of the roof to reduce risk of wind loading.

Figure 6.3: Illustration of the Building with Indicative Solar Arrays on Rooftops

6.10.7 The rooftop plan shows No. 20,915 panels rated at 300Wp, resulting in a total installed capacity of 6.274MWp. This installed capacity of solar PV is expected to generate 5,020MWh over the course of a year.

6.10.8 Despite the large number of solar panels, the total generation will only cover a small amount of the total demand. There is unlikely to be any surplus electricity and hence there will be no requirement to export to the electricity grid.

7 SITE WIDE ENERGY AND EMISSION REDUCTIONS

7.1 Introduction

7.1.1 This energy strategy has been determined based on a model of the energy demands and carbon emissions arising from the operation of the development.

7.1.2 In constructing the development, the Applicant will meet or exceed the building regulation requirements in place at the time of commencement. This is likely to include the 27% reduction in regulated emissions which is expected to be incorporated into the interim Future Building Standard from June 2022.

7.2 Predicted Emissions Before Mitigation

7.2.1 Detailed SBEM assessment has not been undertaken at this stage, but a model of the of energy (both regulated and unregulated) required to operate the plant, and the associated emissions has been developed to help inform the decision-making process.

7.2.2 Scenario A (without additional mitigation) is considered to be an appropriate baseline scenario. The use of gas-fired boilers and steam plant is typical for a manufacturing development of this type. Switching to an all-electric solution would therefore be considered a mitigation in itself, as with grid decarbonisation it would tend towards a zero-carbon solution over time. In this instance however, it is not possible to declare that an all-electric solution is definitely viable and will be adopted, although it is the strong preference.

7.2.3 Table 7.1, below presents the baseline energy demand and emissions for the development over its lifetime of operation. Note, only Scope 1 and 2 emissions are included here.

Table 7.1: Baseline Lifetime Energy & Emissions from Project

Description	Energy	Emissions
Construction	8.6 GWh	2,175 tCO_2e
Operation		
Common Electrical Demand	10,393.4 GWh	567,002 tCO_2e
Low Temp Hot Water	6,556.0 GWh	1,200,803 tCO_2e
High Temp Hot Water	7,645.1 GWh	1,521,001 tCO_2e
Dehumidifiers	3,588.2 GWh	657,207 tCO_2e
Decommissioning	8.6 GWh	1,976 tCO_2e
Total Demand	**28,199.9 GWh**	**3,950,164 tCO_2e**

7.3 Predicted Emissions After Mitigation

7.3.1 As discussed above, mitigation in the form of Solar PV and ASHPs have been proposed as part of the strategy to transition to a zero carbon development. This would be in addition to the other measures, such as improved fabric efficiency, potential WWHR systems and energy efficient lighting etc, which have not been assessed in detail due to the lack of SBEM assessment.

7.3.2 Despite of the vast size of the plant, regulated energy use forms a relatively small proportion of the overall energy use. The majority of demand at the site will be associated with process energy required to manufacture the batteries.

7.3.3 In instance where gas is used as the primary source of this energy, the most energy intensive operations will be:

- Low Temperature Hot Water (LTHW) Gas Boilers
- High Temperature Hot Water (HTHW) Gas Boilers (Steam Plant)
- Dehumidifiers with gas reactivation burners;

7.3.4 In the all-electric scenario, the most energy intensive components are:

- Low Temperature Hot Water (LTHW) Electric Boilers
- Coater Dryer Electric Dryer
- Dehumidifiers with electric reactivation burners;

7.3.5 Table 7.2 and Table 7.3, below show the updated lifetime energy and emissions figures for each scenario once the mitigation has been introduced, which can be compared to the baseline above.

Table 7.2: Scenario A Energy & Emissions in Yr1 of Project with mitigation

Description	Energy	Emissions
Construction	8.6 GWh	2,175 tCO_2e
Operation		
Common Electrical Demand	10,393.4 GWh	567,002 tCO_2e
Low Temp Hot Water	6,556.0 GWh	1,200,803 tCO_2e
High Temp Hot Water	7,645.1 GWh	1,521,001 tCO_2e
Dehumidifiers	3,588.2 GWh	657,207 tCO_2e
Mitigation (ASHPs & PV)	-318 GWh	-64,620 tCO_2e
Decommissioning	8.6 GWh	1,976 tCO_2e
Total Demand	**27,881.9 GWh**	**3,885,544 tCO_2e**

Table 7.3: Scenario B Energy & Emissions in Yr1 of Project with mitigation		
Description	**Energy**	**Emissions**
Construction	8.6 GWh	2,175 tCO_2e
Operation		
Common Electrical Demand	10,393.4 GWh	567,002 tCO_2e
Low Temp Hot Water	6,366.3 GWh	347,308 tCO_2e
High Temp Hot Water	7,741.4 GWh	422,327 tCO_2e
Dehumidifiers	3,588.2 GWh	195,749 tCO_2e
Mitigation (ASHPs & PV)	-318 GWh	-19,097 tCO_2e
Decommissioning	8.6 GWh	1,976 tCO_2e
Total Demand	**27,788.6 GWh**	**1,517,440 tCO_2e**

7.3.6 The graphs below provide a visual representation of data in the tables above.

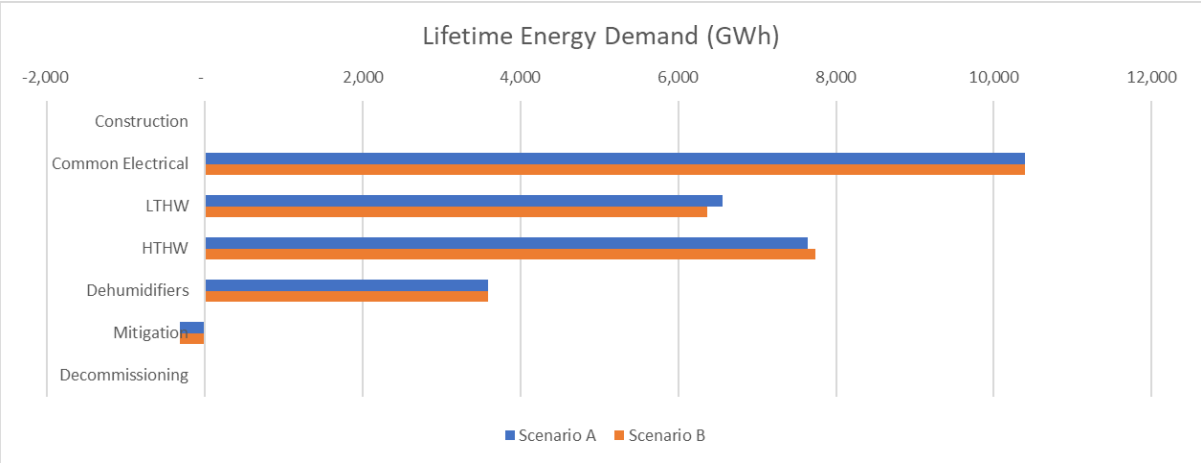

Figure 7.1: Comparison of Lifetime Energy Use in Each Scenario

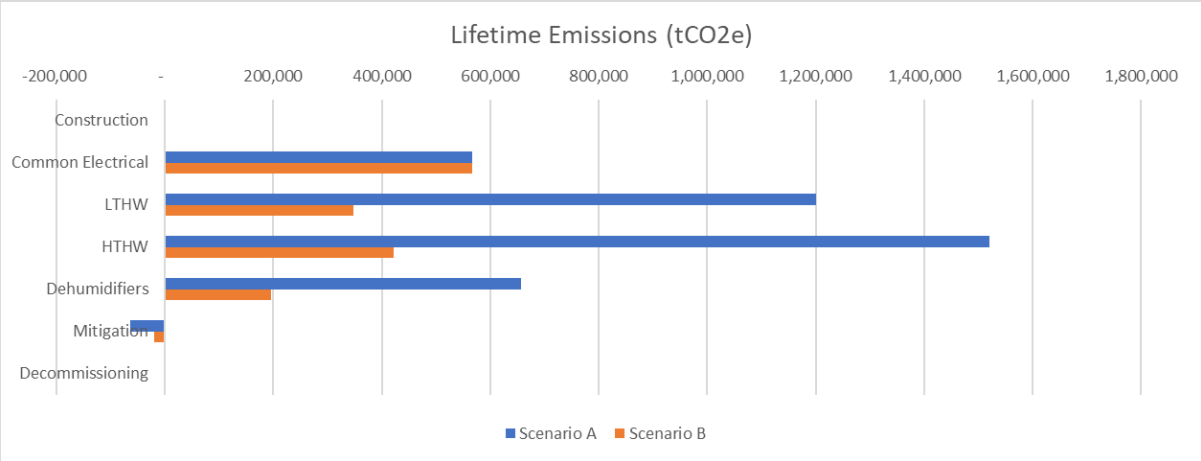

Figure 7.2: Comparison of Lifetime Emissions (Scopes 1 & 2) in Each Scenario

7.3.7 Although the ASHPs and, particularly the solar PV, contribute sizeable reductions in energy, (annual PV generation is equivalent to energy consumed by 1,331 homes based on average GB household consumption[2]), it is still a minor contribution next to total energy consumption.

7.3.8 It is clear that Scenario B produces considerable emissions savings over the lifetime of the development. Whilst the quantum of energy used each year would be expected to remain consistent across the lifetime of the project, the decarbonisation of the electricity grid would massively reduce the emissions from the plant, even if this only takes place at the speed that the National Grid is projected to decarbonise. If Envision are able to accelerate the decarbonisation of their supply, either through additional direct renewable generation or from purchasing only renewable electricity, then the emissions savings will be even greater.

7.3.9 Given the large energy requirements from the plant and associated emissions, the obvious question is whether the plant can actually be beneficial from an energy and carbon perspective at all. To answer that question it is necessary to consider the effect of the batteries being produced. The battery production rate is estimated to be 100,000 batteries a year. Recent car sales (2018-2020) show 62.7% have been petrol fuelled and 17.5% have been diesel fuelled, with the remaining 19.8% split between various electric vehicles[3]. Therefore, logically most new electric vehicle sales will displace fossil fuelled vehicles on the road. According to government figures the average mileage per year in 2019 (pre-covid) was 7,400mls[4]. Assuming 62,700 petrol vehicles and 17,500 diesel vehicles are displaced and the average emissions for each of those vehicles are saved, this would be equivalent to 117,211tCO_2e per year, provided the electric vehicles are charged by decarbonised electricity. This is more than 27,000tCO_2e greater than is expended in Scopes 1 & 2 from the operation of the

[2] BEIS, "*Sub-national electricity consumption statistics 2005 to 2019*", 2019 data published by Dept Business, Energy and Industrial Strategy, Dec 2020, https://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics (Accessed: 11/07/2021)

[3] Statistica, "*Passenger car registrations in the UK between 2018 and 2020, by fuel type*", https://www.statista.com/statistics/299031/fuel-types-of-new-cars-registered-in-the-united-kingdom/ (Accessed 06/07/2021)

[4] Dept for Transport Statistics – National Travel Survey - Table NTS0901, "*Annual mileage1 of cars2,3 by ownership and trip purpose: England, 2002 onwards*", August 2020, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/906055/nts0901.ods (Accessed 07/07/2021)

Gigafactory in Scenario A in Year 1. It is nearly 18,787tCO_2e more than is expended in Scenario B. Although this shows a greater benefit in Scenario A, the situation will quickly reverse with ongoing grid decarbonisation, with the greater lifetime benefits coming in Scenario B. What is more, those vehicles will be on the road for far longer than one year, so they will go on providing similar benefit for years to come, as the car industry gradually transitions away from fossil fuels.

7.4 Overarching Envision Carbon Targets

7.4.1 The desire to decarbonise the development as far as possible and to strive for zero carbon has been determined at Company Board level and is being actively pursued by the developer. The following extract is part of the Envision AESC's UK target.

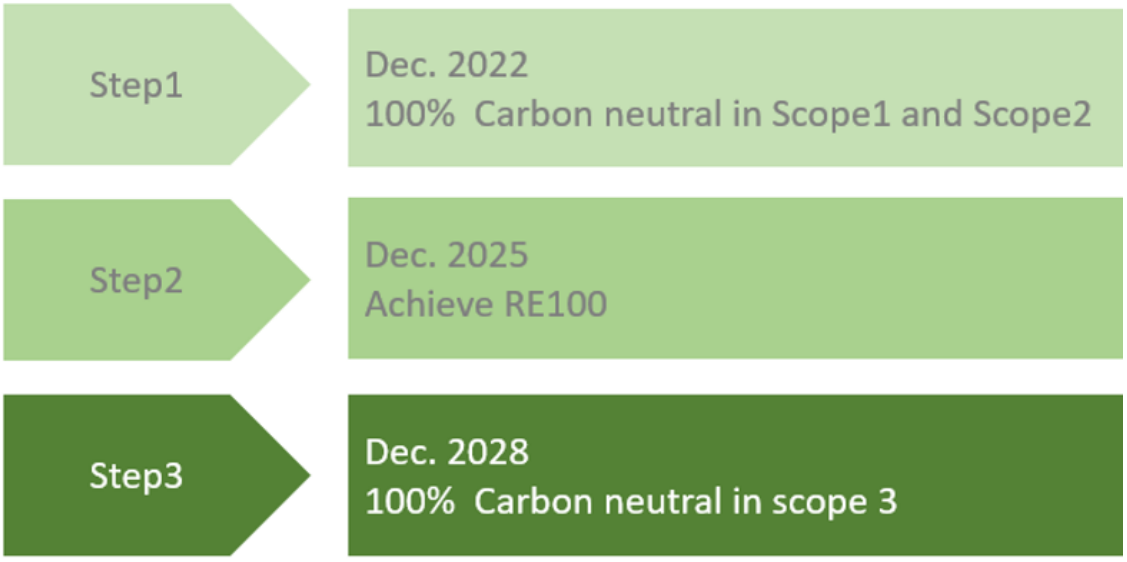

Figure 7.3: Envision AESC UK target

7.4.2 Definition of the various Scopes above is in line with the Greenhouse Gas Protocol. Scope 1 covers direct emission for sources owned or controlled by the Applicant. Scope 2 relates to imported electricity, heat, steam or cooling. Scope 3 relates to indirect emissions upstream or downstream in the value chain. RE100 is an international initiative aiming to procure 100% renewable energy for business activities.

7.4.3 To achieve these targets, the Applicant would be obliged to avoid using gas boilers and plant. The practicality of delivering the Gigafactory plant without using gas remains uncertain, so both options must be kept open for now.

7.4.4 If it is possible to procure suitable equipment to meet the all-electric objective, then Step 1 should be achievable through the use of a zero-carbon tariff for imported electricity. This may include a tariff using nuclear power. Post 2025 the Step 2 target could only be achieved by using an entirely renewable tariff coupled with any onsite renewable generation. It is also noted that to comply with the requirements of the GHG protocol the emissions associated with the electrical import would need to be dual reported using both the emission factor for the tariff and the emission factor for the normal grid mix.

7.4.5 Step 3 will be incredibly challenging and difficult to achieve. Completely decarbonising the entire supply chain both upstream and downstream will require very careful planning. It will be possible to control upstream emissions by switching suppliers if any refuse to comply but influencing downstream emissions will require much more tactful persuasion. It will probably be relatively easy to ensure that, at the end of its useful life, the battery is returned to source rather than disposed of in some other manner, by incentivising safe return and recycling. Other downstream Scope 3 emissions will be much trickier to manage. Persuading vehicle owners to charge their vehicles exclusively from renewable sources may not be possible and so will largely rely on grid decarbonisation or some alternative form of offsetting of emissions.

8 CONCLUSIONS

8.1.1 The Energy Strategy has been developed through consideration of the predicted energy demand across the development and the application of the energy hierarchy to reduce energy use and thereby minimise carbon emissions.

8.1.2 The BE LEAN element of the energy hierarchy is concerned with reducing energy demand. This has been applied through passive sustainable design measures and the use of modern methods of construction and improved specifications for building fabric efficiency.

8.1.3 The BE CLEAN element of the energy hierarchy focusses on supplying energy more efficiently. This usually entails consideration of district heating networks or combined heat and power generation. Neither of these options are considered practical or viable in this proposed development.

8.1.4 The final element of the energy hierarchy is BE GREEN, which involves the use of renewable technologies and reduce the carbon emissions associated with supplying the energy demands for the Development. The Energy Strategy set out in this report uses Solar PV as the primary means of reducing carbon emissions, along with ASHPs in the office areas, improved fabric efficiency and potentially Waste Water Heat Recovery (WWHR).

8.1.5 The energy demand from the development is split between regulated energy to operate the building facilities and unregulated energy which is used for running the manufacturing processes. There is a strong desire to decarbonise the production process but at present gas is the normal source of the heat that is required. If it can be demonstrated to be technically viable and affordable to do so, the plant will adopt an all-electric approach which will be much easier to decarbonise as the electric grid itself decarbonises. There will also be potential for additional onsite renewables to be added to the energy supply.

8.1.6 For the purpose of the assessment two scenarios have been presented:

- Scenario A with gas boilers; and,
- Scenario B with all electric heat and power.

8.1.7 Estimates of the energy requirements for both of these scenarios are presented below.

Table 8.1: Scenario A Energy & Emissions in Yr1 of Project with mitigation		
Description	**Energy**	**Emissions**
Construction	8.6 GWh	2,175 tCO_2e
Operation		
Common Electrical Demand	10,393.4 GWh	567,002 tCO_2e
Low Temp Hot Water	6,556.0 GWh	1,200,803 tCO_2e
High Temp Hot Water	7,645.1 GWh	1,521,001 tCO_2e
Dehumidifiers	3,588.2 GWh	657,207 tCO_2e
Mitigation (ASHPs & PV)	-318 GWh	-64,620 tCO_2e
Decommissioning	8.6 GWh	1,976 tCO_2e
Total Demand	**27,881.9 GWh**	**3,885,544 tCO_2e**

Table 8.2: Scenario B Energy & Emissions in Yr1 of Project with mitigation		
Description	**Energy**	**Emissions**
Construction	8.6 GWh	2,175 tCO_2e
Operation		
Common Electrical Demand	10,393.4 GWh	567,002 tCO_2e
Low Temp Hot Water	6,366.3 GWh	347,308 tCO_2e
High Temp Hot Water	7,741.4 GWh	422,327 tCO_2e
Dehumidifiers	3,588.2 GWh	195,749 tCO_2e
Mitigation (ASHPs & PV)	-318 GWh	-19,097 tCO_2e
Decommissioning	8.6 GWh	1,976 tCO_2e
Total Demand	**27,788.6 GWh**	**1,517,440 tCO_2e**

8.1.8 The mitigation proposed includes the rooftop solar PV installation, which is expected to be rated at 6.2MWp, and the ASHPs that are proposed for the office spaces. The buildings are so vast that these measures alone may be insufficient to meet the Future Building Standard so it is anticipated that enhanced fabric will be incorporated and WWHR may also be required to help deliver the target 27% emission reduction for regulated emissions. SBEM assessments will help determine this once final detail of internal design and fit out is confirmed. In all cases the minimum building regulations will be met or exceeded.

8.1.9 It is proposed that ongoing monitoring will take place through ongoing analysis of energy use statistics and ensuring mechanisms are in place to optimise use and increase efficiency wherever possible. In the unlikely event that regulated energy use is not performing as expected, remediatory action will be undertaken to ensure that these minimum standards are complied with, either through snagging improvements

or through additional or alternative upgrade measures should this be necessary will be considered to ensure that, as a minimum, the proposed targets are met.

8.1.10 Envision has strong internal drivers to reduce its carbon footprint both internally and also throughout it supply chain. Since the production process inherently relies on consuming large amounts of power, this can only be achieved by decarbonising its energy use. Envision is also looking at options to help ensure its upstream and downstream value chains decarbonise as well.

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