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AESC UK

AESC Plant 3 Development

Environmental Statement

APPENDIX 3.2 Energy Statement

February 2024

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Wardell Armstrong LLP
City Quadrant, 11 Waterloo Square, Newcastle upon Tyne, NE1 4DP, United Kingdom
Telephone: +44 (0)191 232 0943 www.wardell-armstrong.com

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AESC UK

AESC Plant 3 Development

Planning Application and Environmental Impact Assessment

Appendix 3.2 Energy Statement

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PREPARED BY:

Connor Davies	Consultant (Energy & Climate Change)	

REVIEWED & APPROVED BY:

Simon Allen	Technical Director (Energy & Climate Change)	

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Registered office: Sir Henry Doulton House, Forge Lane, Etruria, Stoke-on-Trent, ST1 5BD, United Kingdom

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CONTENTS

TABLES

FIGURES

ACRONYMS

AAP	Area Action Plan
AESC	Automotive Energy Supply Corporation
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
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
CoP	Co-efficient of Performance
CV	Calorific Value
DECC	Former government Department of Energy & Climate Change
DHN	District Heat Network
dte	Dry Tonnes Equivalent (measure of wood fuel)
ESCo	Energy Supply Company
EV	Electric Vehicle
FBS	Future Buildings Standard
FEES	Fabric Energy Efficiency Standards
GSHP	Ground Source Heat Pump
HIU	Heat Interface Unit
HQ	Headquarters
HTHW	High Temperature Hot Water (steam plant)
HV	High Voltage
IAMP	International Advanced Manufacturing Park
kVA	kilo Volt Amp
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
LTHW	Low Temperature Hot Water
MEP	Mechanical, Electrical, Plumbing
MEV	Mechanical Extract Ventilation
MHCLG	Ministry of Housing, Communities & Local Government
MMC	Modern Methods of Construction
MVHR	Mechanical Ventilation with Heat Recovery
MWh/yr	Megawatt hour per year
NPPF	National Planning Policy Framework
PPA	Power Purchase Agreement
PPG	Planning Practice Guidance
PV	Solar Photovoltaic

SAP	Standard Assessment Procedure (to model domestic energy consumption)
SAP 10	Current Standard Assessment Procedure (for use with Part L 2021)
SAP 11	Future Standard Assessment Procedure (for use with Part L 2025)
SAP 2012	Former Standard Assessment Procedure (for use with Part L 2013)
SBEM	Simplified Building Energy Model (to model commercial energy consumption)
SCC	Sunderland City Council
SCoP	Seasonal Co-efficient of Performance
SPD	Supplementary Planning Document
STC	South Tyneside Council
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 AESC UK (the Applicant). The site is part of the International Advanced Manufacturing Park (IAMP), which is being delivered through a joint venture between Sunderland City Council (SCC) and South Tyneside Council (STC). The site itself lies within the administrative area of SCC. Wardell Armstrong LLP (WA) 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 Proposed Development lies with the boundary of the overall International Advanced Manufacturing Park (IAMP) as identified in the IAMP Area Action Plan (AAP) 2017-2032 (adopted 2017). The Site lies adjacent to AESC Plant 2, which was granted planning consent in October 2021 (Ref.21/01764/HE4) and is currently under construction

1.2.2 The redline development boundary is approximately 42.39 ha (104.74 acres). The Proposed Development comprises AESC Plant 3, an assembly & warehousing building and an office headquarters building for AESC UK, with associated infrastructure including ancillary MEP plant rooms, gatehouse, car parking, bicycle shelter and the high voltage (HV) substation.

1.2.3 The Proposed Development consists of a 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 12 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. In addition, a large assembly and warehousing building will be developed to package and store the batteries following manufacture. In addition to office space provided within the other buildings, a self-contained office building will be established near the carpark to accommodate AESC's headquarters function, and a small gate house building will control access to the carpark.

1.2.4 The facility will employ circa 1,900 staff consisting of circa 1,500 continental shift workers, 120 three-shift workers, 75 two-shift workers and circa 220 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 71x 7 kWh electric vehicle charging bays.

1.2.5 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. The proposed facility will also house an assembly & warehousing building, AESC UK Office HQ building and ancillary plant rooms. The development is proposed to be adjacent to the existing battery plant under construction.

1.2.6 Figure 1.1, below, shows the plan of the Proposed Development. Figure 1.2, below, shows a 3D representation of the Proposed Development and identifies those elements of the build that are referred to in this report.

Figure 1.1: Envision AESC UK Battery Plant – Site Plan

(Extract of site Plan produced by RPS)

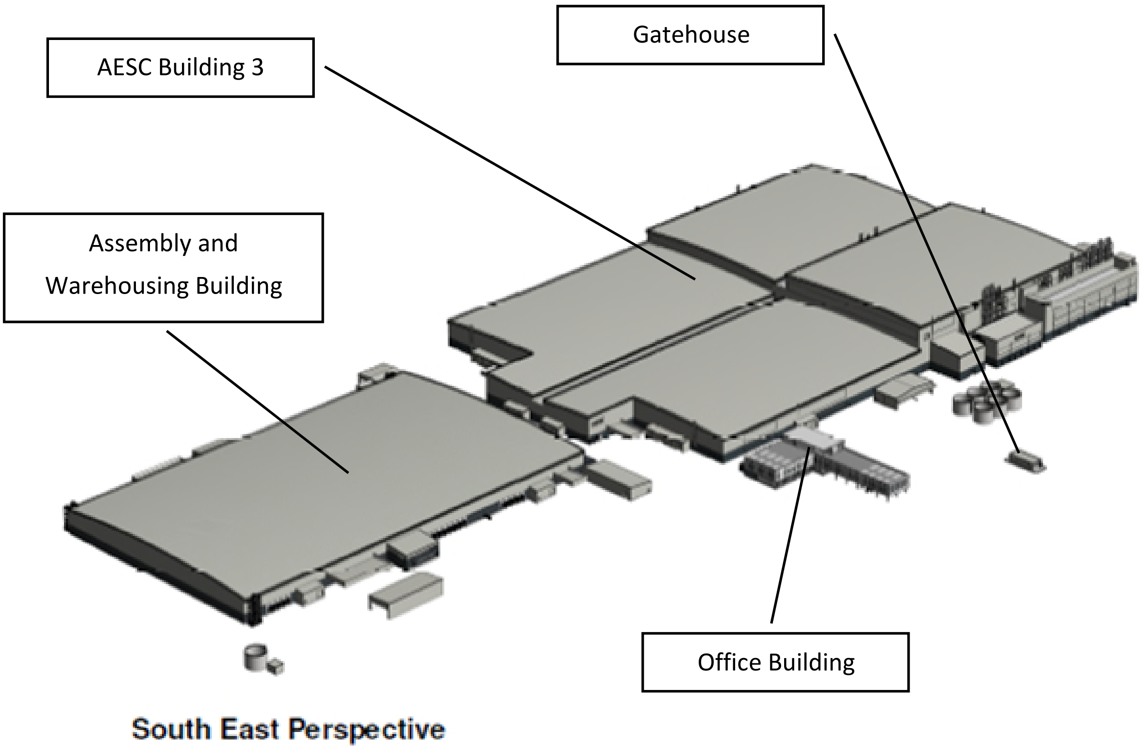

Figure 1.2: Envision AESC UK Battery Plant – 3D Representation

(Extract of Plot 2 3D Views produced by RPS)

1.2.7 The 'interim' Future Buildings Standard (Part L 2021) came into force in June 2022 and requires that all non-residential development achieve a minimum of 27% emission reduction compared to the previous standard, Part L 2013. The 'full' Future Buildings Standard is expected to come into force in June 2026, with an ambitious emission reduction target (still to be confirmed, but if it follows the trajectory of the residential target, it will be 75-80%). Recognising that, subject to the necessary consents, work on the Proposed Development, is likely to commence prior to 2025, it will be bound by the Part L 2021 Regulations although AESC will seek to improve on this where possible.

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 (NPPF) and the Planning Practice Guidance (PPG). 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

2.2.1 The NPPF was first published in March 2012 and recently updated in 2023. The NPPF is a material consideration that must be taken into account in the determination of planning applications. The NPPF was most recently updated December 2023 and, along with the PPG, forms the main body of national planning policy in the UK, relevant to this application.

2.2.2 The cornerstone of the NPPF is the "*presumption in favour of sustainable development*" (paragraph 11) to ensure that sustainable development is pursued in a positive way. 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 NPPF as a whole. Development that is sustainable should proceed.

2.2.3 Chapter 14 of the NPPF, 'meeting the challenge of climate change, flooding and coastal change', notes several relevant points. Firstly, paragraph 157 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*." 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 159).

2.2.4 Paragraph 160 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*."

2.2.5 Paragraph 162 notes that 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 2015-2033 (adopted January 2020) 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 The International Advanced Manufacturing Park Area Action Plan 2017-2032 (adopted Nov-2017) forms a part of both Sunderland and South Tyneside's development plan documents and sets the planning policy framework against which applications within the IAMP area are assessed. A review (undertaken October 2022) concluded that "*the policies of the AAP remain effective and consistent with national policy*".

2.3.4 There is specific energy related policy included within the IAMP AAP, which states:

"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."

2.3.5 Policy, therefore, 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 On 19 January 2021, the Government published a consultation on Future Building Standards (FBS), which was aimed at promoting decarbonisation in new non-residential and existing residential buildings.

2.4.2 Part L 2021 (and Part F 2021) regulations came into effect in June 2022, and are intended as interim arrangements prior to the expected adoption of the full 2025 FBS in June 2026. The 2021 interim regulations require a 27% reduction in CO_2 emissions for non-domestic buildings, compared to the previous Part L 2013 standards.

2.4.3 The FBS is intended to complement the Future Homes Standard (FHS). The FBS (for commercial property) and the FHS (for residential property) are the primary mechanisms by which the Government aims to 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.

2.4.4 Part L of the Buildings Regulations state that new buildings must achieve a Target Primary Energy Rate (TPER), a Target Emission Rate (TER) and a Target Fabric Energy Efficiency (TFEE) rate.

2.4.5 For non-residential development, these metrics must be calculated using the Simplified Building Energy Model (SBEM). The current version is v6.1, which came into use as of June 2022.

2.4.6 Standard Assessment Procedure (SAP) software is used to model residential development, but emission factors used in the software are also used in the SBEM software. SAP11 is expected to come into effect in 2025, alongside the Future Homes Standard update to the Building Regulations. It is expected that the SAP11 assessments (and the corresponding SBEM equivalent) will be more rigorous, contemporary, and give more accurate results to tie in with the Net-Zero objectives.

2.4.7 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/m^2/yr, which is affected by:

- Building fabric U-values;
- Thermal bridging;
- Thermal mass; and
- Features effecting lighting and solar gains.

2.4.8 Various combinations of fabric efficiency measures may be employed to meet the TFEE limit. There are also limiting standards for the properties of individual fabric elements within the building, although the overall specification across all elements needs to be considerably better than the sum of 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.

EV Charging

2.4.9 Part S of Building regulations, which includes 'Section 3: New buildings other than residential or mixed-use buildings', states.

"For new buildings other than residential or mixed-use buildings with more than 10 parking spaces, both of the following apply.

a. One electric vehicle charge point must be provided for the building.

b. At least one in every five remaining parking spaces must be provided with cable routes.

The requirement to install an electric vehicle charge point and cable routes applies to parking spaces that serve new buildings other than dwellings where the parking spaces are in either of the following locations.

a. Within the building.

b. Within the site boundary.

3.3 Where any of the parking spaces for new buildings other than residential or mixed-use buildings are in a covered car park, the requirement to install an electric vehicle charge point should be met by installing a charge point in a parking space that is not within a covered car *park. The requirement to install cable routes only applies to parking spaces within a covered car park if there are insufficient parking spaces outside the covered car park to meet paragraph 3.1b.*

3.4 Where all parking spaces are within a covered car park, the requirement to install an electric vehicle charge point does not apply. Cable routes must still be provided for a minimum of one in five parking spaces."

2.4.10 The Proposed Development is to include a 780 space car park, meaning that a minimum of 156 spaces must be provided with cable routes.

3 ENERGY REQUIREMENTS

3.1 Construction

3.1.1 Given the scale of the development, the construction process will require a considerable amount of materials to build and will use a substantial amount of energy to complete the necessary works. Whilst some elements of the detailed design process remain to be finalised, estimates of the construction energy requirements have been made to help inform the Energy Statement.

3.1.2 During construction, different vehicles and equipment will be used to transport materials around the site to the point of use and installation. Breakdowns of expected fuel requirements have, in the main, 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 may alter these figures.

3.1.3 It is estimated that 716,300 litres of fuel would be required onsite during construction of AESC Plant 3 for the operation of cranes, excavators, forklifts, screeders, bull dozers, rollers and dump trucks, *etcetera*. These would breakdown roughly as per Table 3.1, 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**

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

3.1.5 Table 3.1 illustrates the estimated construction fuel requirements for AESC Plant 3 based on estimates provided by contractors. The equivalent information is not directly available for other components of the build (such as the assembly and warehousing building, AESC UK Office HQ, gatehouse, and the ancillary plantrooms). The fuel requirements for these elements has been estimated from modelling high-level modelling in OneClick LCA lifecycle analysis software. The emissions calculated in the software have been reverse processed to estimate construction energy requirements, after accounting for the fact that the emissions reported by the software include Scope 3 emissions. The differing methodologies create some potential for discrepancies, but (given the level of detailed design available) represent a fair estimation at this stage. On this basis, the total fossil fuel requirements for the construction phase including AESC Plant 3 and the other units, is estimated to be 1,960,838 litres of gas oil, equivalent to 20,780 MWh of energy.

3.1.6 It is also estimated that circa 937,500 kWh of imported electrical energy will be required during the construction phase to operate various pumps, tools and other items of equipment during the build out of AESC Plant 3. The equivalent breakdown of electrical energy is not directly calculable from the OneClick LCA outputs and it is likely that some of the energy use attributed to Scope One fuel oil in the model would, more accurately, comprise Scope 2 imported grid electricity. However, this is largely an accounting issue and will not affect the carbon emissions that are the direct output from the model.

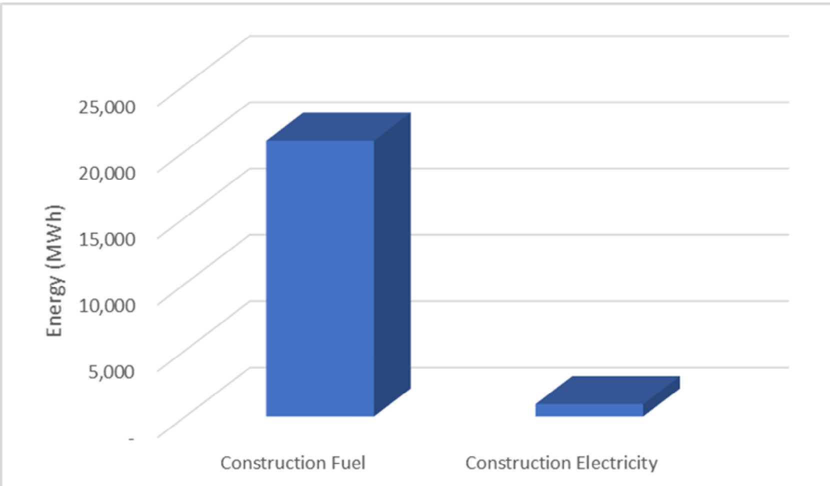

Figure 3.1: Estimated Energy Use During Construction

3.2 Operation

3.2.1 The Proposed Development 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. In addition, the assembly & warehousing building will be used to package and store the completed products prior to shipping. The AESC UK Office HQ building will facilitate the management of company operations, and other smaller units include minor plant buildings and a gatehouse.

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

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

Common Electrical Requirements for AESC Building 3

3.2.4 In both scenarios, there would be common elements that would require electrical energy supply, regardless of the heating sources. These are summarised in Table 3.2, below.

Table 3.2: AESC Building 3 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**

3.2.5 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 which would be controlled by Building Regulations. Figures provided are estimated but a detailed SBEM assessment will be prepared in due course, in accordance with Building Regulations.

Scenario A for AESC Building 3

3.2.6 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.

3.2.7 The Babcock Wanson HW3P Hot Water Boiler is a full three-pass fired heater designed for operation with Natural Gas (see Figure 3.2). For planning purposes, it is assumed that there would be five of the HW3P 2510 units required, each rated at 2.5 MW_{th}, and providing a total rated capacity of 12.5 MW_{th}. These boilers would be utilised 24-hours a day, 7-days a week across the operating period of the plant, which is assumed to be 48-weeks 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. The predicted fuel requirements to sustain this operation are 109,276 MWh of gas.

Figure 3.2: NW3P Series Boilers from Babcock Wanson

3.2.8 The steam plant is expected to comprise three BWR 150A boilers (see Figure 3.3, below). 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

3.2.9 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 20 MW_{th} boilers are expected to require 159,272 MWh worth of gas to cover the same 48-week operational period.

3.2.10 The dehumidifier plant comprises a large rotating desiccant rotor that absorbs moisture from input 'wet air' that is fed into the plant (see Figure 3.4, 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. 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.

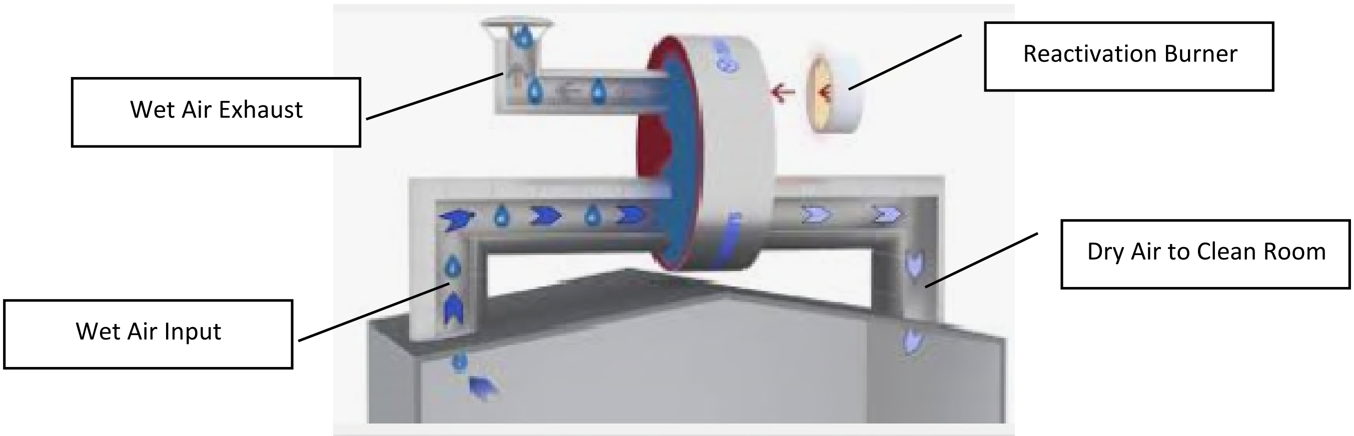

Figure 3.4: Dehumidifier Process

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

Scenario B for AESC Building 3

3.2.12 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: AESC Building 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

3.2.13 The all-electric option appears to show a slight 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 a detailed system design for the all-electric approach is not currently available and some assumptions have been used to arrive at this figure. Consequently, the level of energy saving must be caveated to recognise this uncertainty.

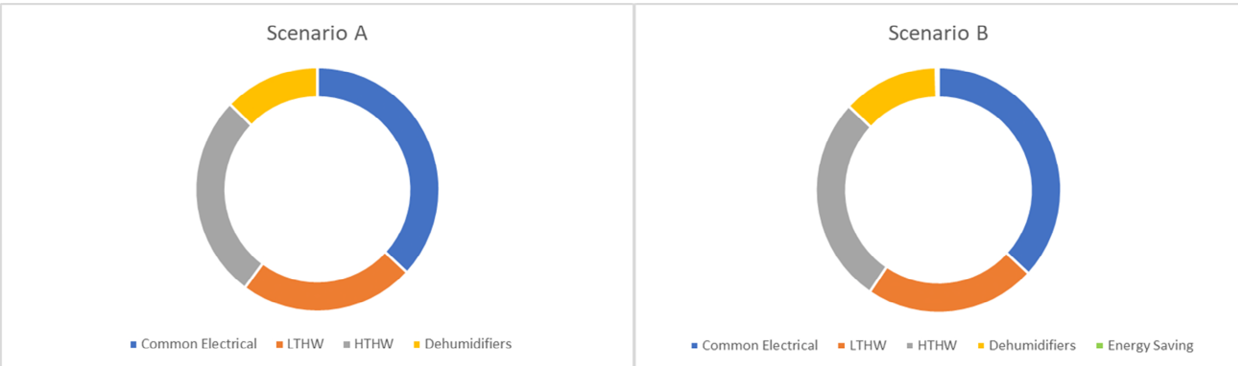

Figure 3.5: Annual Energy Use for Each Scenario

3.2.14 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. 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 60 years. 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. For the purpose of this assessment, it is 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. The term MMC (or 'smart construction') is used to describe a set of building techniques centred around the offsite production of panels that can be easily assembled onsite.

4.2.2 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 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 full detailed lifecycle analysis of every component used in the construction at this stage (as this would be excessive), but embedded emissions associated with bulk components have been estimated in the assessment above.

4.3.3 There is limited opportunity in this industrial setting but maximising the use of such materials as timber, which tend to have much lower embodied energy content than man-made products (e.g. 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; these will be completed once the contractor has fully specified the detailed design. The figures contained in the Energy Statement for regulated energy use (i.e. 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. Essentially, this is a methodology for recording the materials used in construction and 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
- 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. 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 onsite. Wherever possible, the Proposed Development will retain existing mature trees and vegetation from the field demarcation, around the perimeter. 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 Owing to the industrial nature of the activities inside, AESC Plant 3 and the assembly & warehousing building will have very few windows. The AESC UK Office HQ and gatehouse will 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, which will heavily influence the appropriate U-values. 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; 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 this 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. The 2025 FBS will specify the minimum U-Values for windows that may be lower than that of the current Building Regulations.

4.10 Waste-Water Heat Recovery

4.10.1 A wastewater heat recovery system (WWHR) is designed to extract useful heat from wastewater that would otherwise flow straight down the drain. The wastewater heats incoming water, 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 (e.g. corridors and stairwells) and external lighting will be energy efficient in design. As a further energy saving measure, movement sensors will be installed (where appropriate) 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 combined heat and power (CHP) to the energy strategy for the development.

5.2 District Heating Network (DHN)

5.2.1 District heating uses centralised heat sources that then provide heating throughout a network of connected buildings, which is available via pre-insulated pipes. District heating is widely championed due to perceived efficiency gains from operating a centralised energy centre, but 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.

5.2.2 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.

5.2.3 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 Proposed Development.

5.2.4 It is understood that SCC is aiming to deliver a large district heat network within the city using heat from the former Wearmouth Colliery. Whilst it is understood that plans for 12 months of exploratory drilling are progressing this has only just commenced and results are not expected for another 10 months or so[1]. With the heat source situated over 5 km from the site (as the crow flies), the timeline for delivery not being suited to supplying the AESC Plant 3 development and the risk involved in whether or not the project would actually progress, this is not a realistic option for heat supply. It is also not viable for the plant to setup its own district heating facility to supply heat

[1] BBC, '*Geothermal energy: Sunderland mine scheme moves forward*' April 2023, https://www.bbc.co.uk/news/uk-england-tyne-65191284 [Accessed: 24/09/2023].

offsite; all heat generated onsite will be used by the processes onsite so there would be no surplus for export.

5.3 Combined Heat and Power

5.3.1 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.

5.3.2 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.

5.3.3 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 and, thus, typically used to handle peak load demands with grid electricity import.

5.3.4 Gas CHP may be a suitable technology for the 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 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. A number of technologies have been summarily scoped out of further study (discussed below) based on 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, but research suggests that these often do not perform well and produce 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 and 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 IAMP site. 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 AESC 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 nearby site 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 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

6.5.1 Anaerobic digestion (AD) 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 onsite. Even given the size of the plant being developed, the staff would only generate a relatively small amount of food and sewage waste. As such, 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

6.6.1 Ground space is at a premium and there is insufficient room or cost-benefit to accommodate a ground-mounted solar photovoltaic (PV) array in close proximity to the site. Even if this were not the case, overshadowing from adjacent buildings (existing and proposed) 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, 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 preheat a thermal store, with the primary heating system being used to ensure the supply temperature is reached. 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.

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

6.7.4 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 would be producing most heat (i.e. in the summer).

6.7.5 For the above reasons, solar thermal collectors have not been pursued in the energy strategy for the Proposed Development.

6.8 Ground Source Heat Pumps

6.8.1 Ground Source Heat Pumps (GSHP) can be used to meet space heating requirements. They are generally suited to buildings that require low-level continuous heating and 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 the proposed 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. 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 that 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)

6.9.2 Since the refrigeration cycle draws-in heat from the surroundings, less input energy is required to achieve a set level of heating than 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). 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.

6.9.3 In this instance, the separate office block is spread across three floors, with a combined floor area of 3,907 m^2. A further 1,929 m^2 of office space is included in the assembly and warehousing building. The predicted heat demand for the space heating and hot water is 261 MWh/yr. If this heat demand was to be supplied by gas boilers with 90% efficiency, it would require 289 MWh/yr of gas to be burnt. However, an ASHP with a CoP of 3 would only require an electrical load of 87 MWh/yr to provide the same amount of heat. Furthermore, 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.

6.9.4 The detailed design and specification of a heat pump solution has not been carried out. Indeed it has not been determined fully whether GSHPs or ASHPs or an alternative heating system would be the preferred option, but an indicative ASHP module, of the design that might be incorporated into the building, 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 and there are a large number of solar PV manufacturers producing panels for the UK (including from Europe, America and China). PV panels are made from collections of PV cells that, 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.

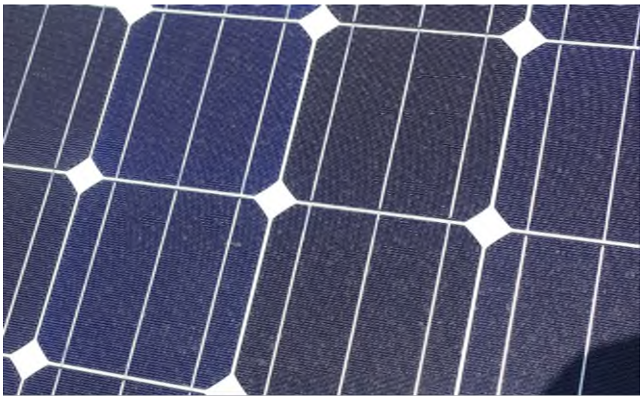

Figure 6.2: Solar PV Cells

6.10.2 The power of a PV cell is measured in watts peak (Wp) or kilowatts peak (kWp), which describes the rate at which it generates energy at peak performance under standard test conditions (STC) (i.e. cell temperature of 25E°C, solar irradiance of 1,000 W/m^2 and air mass of AM1.5).

6.10.3 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 substantial amount of power. Panels located on east-facing roofs will only generate in the morning (while the sun is in the eastern sky) and 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.

6.10.4 It is intended to install solar PV panels on available rooftops across the whole of the site, as shown on the illustration in Figure 6.3, below. Currently, the rooftops of AESC Plant 3 and the assembly and warehousing building have been indicatively shown to be an area for future pv cells, the AESC Plant 3 building having a maximum area of 69,900 m^2 and warehouse with a maximum area of 35,500 m^2. Smaller pv arrays or solar thermal arrays are also intended to be added to the AESC UK office HQ building roof. Gaps will be left between every two rows of panels in the larger arrays to aid access for maintenance a standoff will be left around the perimeter of the roof to reduce risk of wind loading.

Figure 6.3: Building plan with Indicative Solar Arrays on Rooftops

6.10.5 Using the values above, an estimated 34,799 panels, rated at 300Wp, would result in a total installed capacity of 10.44 MWp. This installed capacity of solar PV is expected to generate approximately 8,352 MWh over the course of a year. Despite the large number of solar panels, the total generation will only cover a small amount of the total demand (approximately 15% of regulated electricity use, based on the estimated energy demand figures). 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 Proposed Development. In constructing the development, the Applicant will meet or exceed the building regulation requirements in place at the time of commencement (the interim Future Building Standards from June 2022, stating a 27% reduction in regulated emissions).

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. 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	21.7 GWh	6,256 tCO_2e
Operation		
Common Electrical Demand	11,528.7 GWh	482,867 tCO_2e
Low Temp Hot Water	6,556.0 GWh	1,199,288 tCO_2e
High Temp Hot Water	7,645.1 GWh	1,533,823 tCO_2e
Dehumidifiers	3,588.2 GWh	656,378 tCO_2e
Mitigation	0 GWh	-25,255 tCO_2e

Decommissioning	21.7 GWh	6,256 tCO_2e
Total Demand	**29,361.4 GWh**	**1,236,357 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, and the modelled energy requirements accounts for their inclusion. In the event that alternative heating systems are deployed as part of the tendering process, the emissions savings may vary slightly. This would be in addition to the other measures (e.g. improved fabric efficiency, potential WWHR systems and energy efficient lighting, *etcetera*) that have not been assessed in detail due to the lack of SBEM assessment. In all cases, the emission reductions required under the Part L Regulations would be observed and, where possible, exceeded.

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); and
- 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; and
- 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 Lifetime Energy & Emissions from Project with Mitigation

Description	Energy	Emissions
Construction	21.7 GWh	6,256 tCO_2e
Operation		
Common Electrical Demand	11,528.7 GWh	482,867 tCO_2e
Low Temp Hot Water	6,556.0 GWh	1,199,288 tCO_2e
High Temp Hot Water	7,645.1 GWh	1,533,823 tCO_2e

Dehumidifiers	3,588.2 GWh	656,378 tCO_2e
Mitigation (ASHPs + PV)	-513 GWh	-25,255 tCO_2e
Decommissioning	21.7 GWh	6,256 tCO_2e
Total Demand	**28,848.2 GWh**	**3,859,449 tCO_2e**

Table 7.3: Scenario B Lifetime Energy & Emissions from Project with Mitigation

Description	Energy	Emissions
Construction	21.7 GWh	6,256 tCO_2e
Operation		
Common Electrical Demand	11,528.7 GWh	482,867 tCO_2e
Low Temp Hot Water	6,366.3 GWh	266,646 tCO_2e
High Temp Hot Water	7,741.4 GWh	324,241 tCO_2e
Dehumidifiers	3,588.2 GWh	150,286 tCO_2e
Mitigation (ASHPs + PV)	-513 GWh	-25,225 tCO_2e
Decommissioning	21.7 GWh	6,062 tCO_2e
Total Demand	**28,754.8 GWh**	**1,211,132 tCO_2e**

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

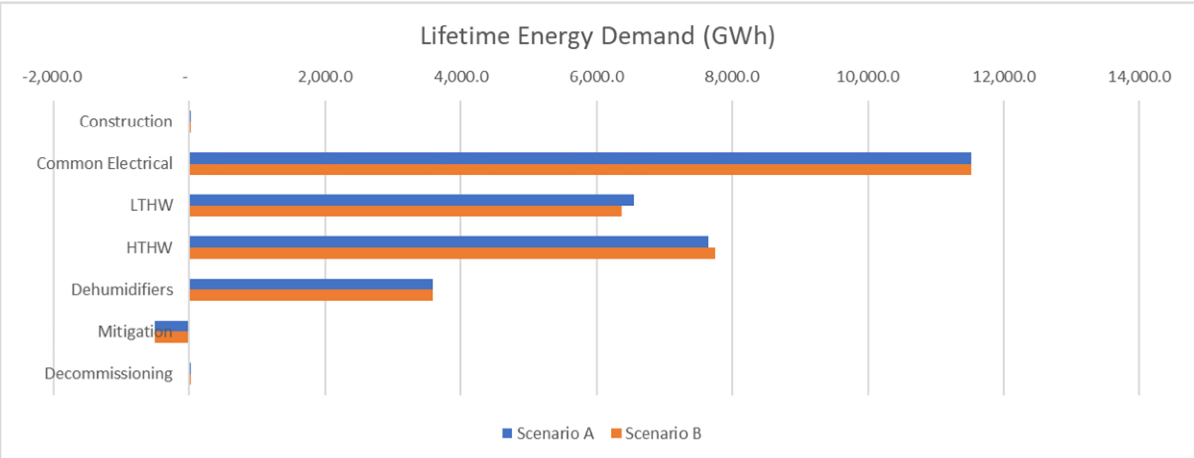

Figure 7.1: Comparison of Lifetime Energy Use in Each Scenario

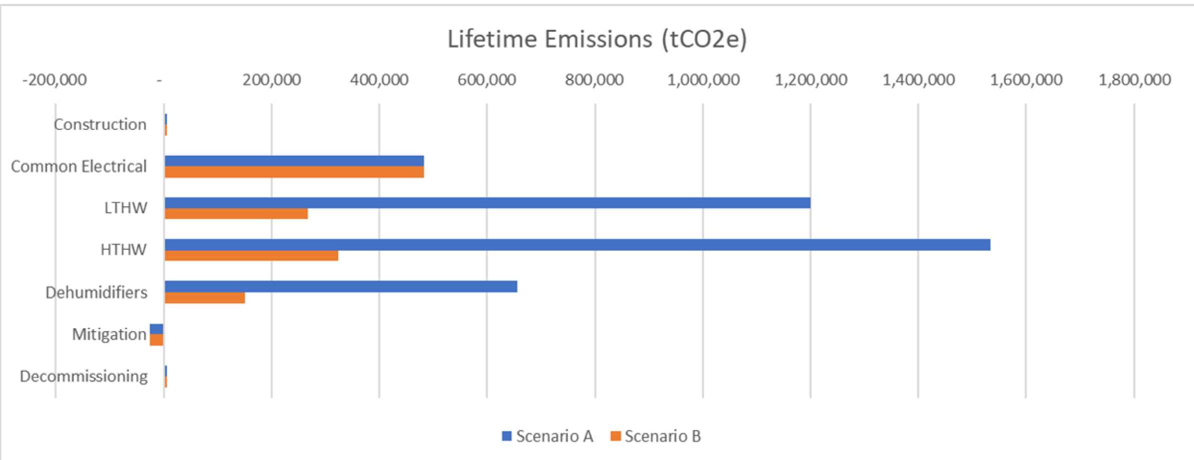

Figure 7.2: Comparison of Lifetime Emissions (Scopes 1 & 2) in Each Scenario

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 2,251 homes based on average GB household consumption[2]), it is still a minor contribution next to total energy consumption. It is clear that Scenario B produces considerable emissions savings over the lifetime of the Proposed Development relative to Scenario A (see Figure 7.3, below). Whilst the quantum of energy used each year would be expected to remain consistent across the lifetime of the Proposed Development, 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 AESC is able to accelerate the decarbonisation of its supply, either through additional direct renewable generation or from purchasing only renewable electricity, the emissions savings will be even greater.

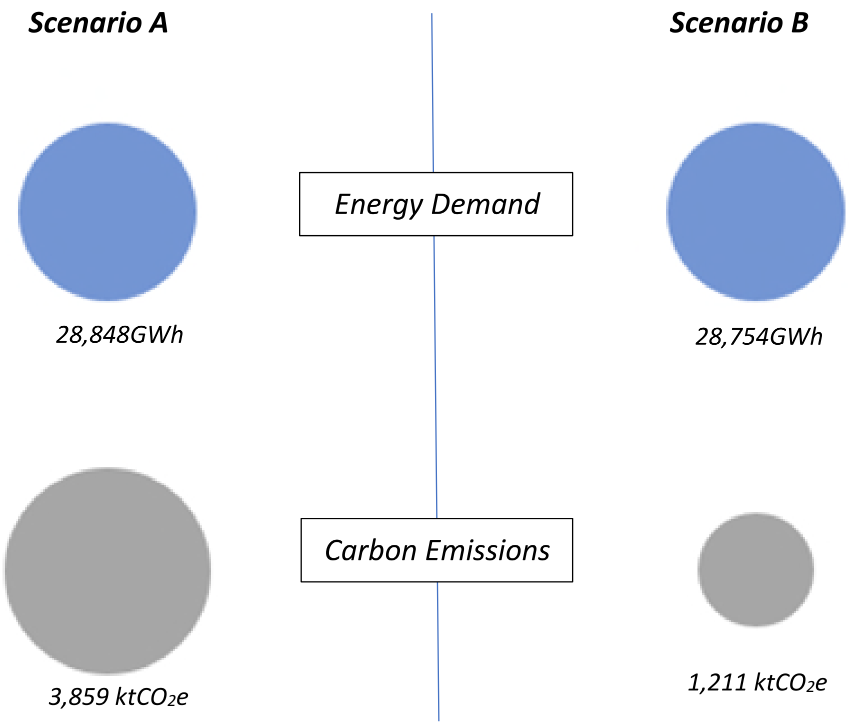

Figure 7.3: Relative Quanta of Energy and Emissions over Project Lifetime

7.3.8 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 this question, it is necessary to consider the effect of the batteries being produced. The battery production rate from AESC Plant 3 has

[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).

been provided by the client; however, it is not specified within this report as the number is commercially sensitive.

7.3.9 Recent car sales figures[3] show that 1,642,000 new cars were sold in 2022. Of these, 50% (↓10% from 2021) have been petrol-fuelled and 8% (↓34%) have been diesel-fuelled, with the remaining 42% split between various electric vehicles (Hybrid Electric (HEV) 20% (↑26%), Plugin Hybrid (PHEV) 6% (↓12%), Battery Electric (BEV) 16% (↑40%)), and 0.2% were other fuel types. Clearly, new electric vehicle sales are starting to displace fossil fuelled vehicles on the road. According to Government figures, the average mileage per car per year in 2023 was 6,600 miles[4].

7.3.10 If the equivalent number of petrol and diesel vehicles were displaced by the number of electric vehicles that AESC Plant 3 can manufacture batteries for (based on the ratios above) and allowing for charging with grid electric, with 6,600 miles being travelled by each over a 12-month period, the average emissions saved would be equivalent to 130,345 tCO_2e per year. If those electric vehicles were charged by decarbonised electricity, savings could rise to as much as 183,785 tCO_2e per year. This is more than 34,720 tCO_2e greater than is expended in Scopes 1 and 2 from the operation of the Gigafactory in Scenario A in Year 1. It is nearly 22,277 tCO_2e more than is expended in Scenario B with the current grid mix. Although this shows a greater benefit in Scenario A, the situation will quickly reverse with ongoing grid decarbonisation as the carbon intensity of grid electric falls below that of natural gas. The greater lifetime benefits, therefore, come with 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 and each year the total stock of vehicles saving emissions as a result of the plant will increase as the car industry gradually transitions away from fossil fuels.

[3] Department for Transport & DVLA, '*Vehicle licensing statistics: 2022*', Published 15 June 2023, https://www.gov.uk/government/statistics/vehicle-licensing-statistics-2022/vehicle-licensing-statistics-2022 (Accessed 27/09/2023).

[4] Dept for Transport Statistics – National Travel Survey - Table NTS0901, '*Annual mileage of cars by ownership fuel type and trip purpose: England, 2002 onwards*' August 2023 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/906055/nts0901.ods (Accessed 27/09/2023).

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 MMC and improved specifications for building fabric efficiency. The BE CLEAN element of the energy hierarchy focusses on supplying energy more efficiently. This entails consideration of DHN or CHP generation. Neither of these options are considered practical or viable in the Proposed Development. 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 Proposed Development. The energy strategy set out in this report uses solar PV as the primary means of reducing carbon emissions, along with the likely inclusion of ASHPs in the office areas, improved fabric efficiency and potentially WWHR.

8.1.3 The energy demand from the development is split between regulated energy to operate the building facilities and unregulated energy 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 that 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.

8.1.4 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.

8.1.5 Estimates of the energy requirements for both of these scenarios are presented in Table 8.1, below.

Table 8.1: Scenario A Lifetime Energy & Emissions from Project with Mitigation		
Description	**Energy**	**Emissions**
Construction	21.7 GWh	6,256 tCO_2e
Operation		
Common Electrical Demand	11,528.7 GWh	482,867 tCO_2e
Low Temp Hot Water	6,556.0 GWh	1,199,288 tCO_2e
High Temp Hot Water	7,645.1 GWh	1,533,823 tCO_2e

Dehumidifiers	3,588.2 GWh	656,378 tCO_2e
Mitigation (ASHPs & PV)	-513 GWh	-25,255 tCO_2e
Decommissioning	21.7 GWh	6,256 tCO_2e
Total Demand	**28,848.2 GWh**	**3,859,449 tCO_2e**

Table 8.2: Scenario B Lifetime Energy & Emissions from Project with Mitigation

Description	Energy	Emissions
Construction	21.7 GWh	6,256 tCO_2e
Operation		
Common Electrical Demand	11,528.7 GWh	482,867 tCO_2e
Low Temp Hot Water	6,366.3 GWh	266,646 tCO_2e
High Temp Hot Water	7,741.4 GWh	324,241 tCO_2e
Dehumidifiers	3,588.2 GWh	150,286 tCO_2e
Mitigation (ASHPs & PV)	-513 GWh	-25,225 tCO_2e
Decommissioning	21.7 GWh	6,062 tCO_2e
Total Demand	**28,754.8 GWh**	**1,211,132 tCO_2e**

8.1.6 Mitigation proposed includes the rooftop solar PV installation, which is expected to be rated at circa 10.4 MWp and is likely to include ASHPs within the office spaces. As the buildings are so vast, these measures alone may be insufficient to meet the interim Future Building Standard and 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.

8.1.7 It is proposed that monitoring will take place through regular systematic 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.

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

wardell-armstrong.com

STOKE-ON-TRENT
Sir Henry Doulton House
Forge Lane
Etruria
Stoke-on-Trent
ST1 5BD
Tel: +44 (0)1782 276 700

BIRMINGHAM
Two Devon Way
Longbridge Technology Park
Longbridge
Birmingham
B31 2TS
Tel: +44 (0)121 580 0909

BOLTON
41-50 Futura Park
Aspinall Way
Middlebrook
Bolton
BL6 6SU
Tel: +44 (0)1204 227 227

BRISTOL
Temple Studios
Temple Gate
Redcliffe
Bristol
BS1 6QA
Tel: +44 (0)117 203 4477

BURY ST EDMUNDS
Armstrong House
Lamdin Road
Bury St Edmunds
Suffolk
IP32 6NU
Tel: +44 (0)1284 765 210

CARDIFF
Tudor House
16 Cathedral Road
Cardiff
CF11 9LJ
Tel: +44 (0)292 072 9191

CARLISLE
Marconi Road
Burgh Road Industrial Estate
Carlisle
Cumbria
CA2 7NA
Tel: +44 (0)1228 550 575

EDINBURGH
Great Michael House
14 Links Place
Edinburgh
EH6 7EZ
Tel: +44 (0)131 555 3311

GLASGOW
24 St Vincent Place
Glasgow
G1 2EU
Tel: +44 (0)141 428 4499

LEEDS
36 Park Row
Leeds
LS1 5JL
Tel: +44 (0)113 831 5533

LONDON
Third Floor
46 Chancery Lane
London
WC2A 1JE
Tel: +44 (0)207 242 3243

NEWCASTLE UPON TYNE
City Quadrant
11 Waterloo Square
Newcastle upon Tyne
NE1 4DP
Tel: +44 (0)191 232 0943

TRURO
Baldhu House
Wheal Jane Earth Science Park
Baldhu
Truro
TR3 6EH
Tel: +44 (0)187 256 0738

International office:

ALMATY
29/6 Satpaev Avenue
Hyatt Regency Hotel
Office Tower
Almaty
Kazakhstan
050040
Tel: +7(727) 334 1310

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