SILCOCK DAWSON & PARTNERS

ENERGY ASSESSMENT

FOR

HATCHERY

HATCH END
INDUSTRIAL ESTATE
BICESTER

VERSION 1.0

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EXECUTIVE SUMMARY

This report has been prepared by Silcock Dawson and Partners on behalf of Middle Aston Ltd to support the proposed redevelopment of Hatchery at Hatch End Industrial Estate.

The development considered in this document comprises the redevelopment of existing storage, commercial buildings to provide 22 business/workshop units, 2 warehouse units and ancillary buildings, with car parking, cycle parking spaces.

The building is designed to be energy efficient and incorporate the following key features:

1. The annual heating demand will be reduced by using insulation values equal to or better than the Notional Building, internal walls and floor slabs between the conditioned offices and unconditioned storage areas will be insulated.

2. LED luminaires, with motion sensors and daylight compensation controls will be installed where possible.

3. Energy efficient mechanical ventilation and comfort cooling will be provided.

To establish the performance of the development without renewable technology, a baseline building model was created, that included a fossil fuel for the heat source in the form of gas fired boilers.

The energy efficient model is expected to achieve a 13.6% betterment over the building regulations target, before renewable energy technologies are applied.

Renewable heat will be supplied to the office units in the form of a reverse cycle heat pump system which will also provide space cooling. The industrial units will largely be unheated, with a small office space allocated with space heating from an air to water heat pump.

The use of heat pumps to provide space heating is predicted to reduce the CO_2 emissions by a further 11%.

The total carbon saving through the combination of energy efficient design, and renewable energy against the baseline building emissions is fifteen tonnes of CO_2 or 24%.

A selection of renewable technologies has been reviewed and a summary is tabulated below.

Technology	Major factors
Biomass	Not viable, the building heat demand could be intermittent, which is not suitable for a biomass boiler which should have a relatively long heat up period, and operate at greater efficiencies when operated for extended periods.
GSHP	Ground Source Heat Pumps (GSHP) Not favoured due to the low building heat demand and potential saving available from a low carbon heat source. Despite the wider adoption of ground source heat pumps, the cost of installing bore holes or slinky installations can still be prohibitively expensive.
ASHP	Air source heat pumps (ASHP) are generally more cost effective than ground source heat pumps, and are suitable within the office spaces in the form of reverse cycle heat pumps designed to provide both space heating and cooling.
Solar Thermal	Solar thermal installations are a well established renewable energy system and can be one of the most cost-effective renewable energy systems available. Solar thermal systems are not viable for this site due to the low domestic hot water demand.
PV cells	Photovoltaic modules convert daylight directly into DC electricity and can be integrated into buildings.
Wind	Not Viable due to the relatively compact nature of the site and available suitable space for a wind turbine. A wind turbine would also generate a large supply from one source, which would be difficult to distribute to the individual units.

The total carbon savings are summarized in the table below.

Table 6: Carbon Dioxide Emissions from each stage of the Energy Hierarchy

	Total Regulated Emissions	CO2 Savings	Percentage Saving
	(Tonnes CO2/year)	(Tonnes CO2/year)	%
Part L 2013 Baseline	60		
Be Lean	52	8	13.6
Be Green	45	6	10.8
Cumulative Saving		15	24.4

1 INTRODUCTION

1.1 Background

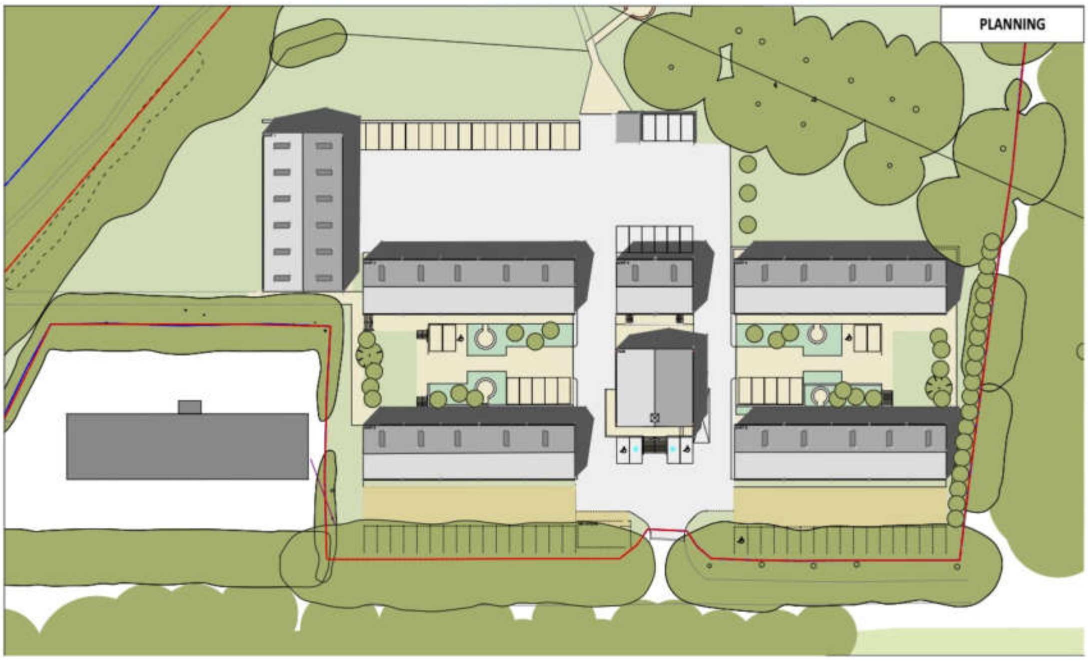
This report has been prepared by Silcock Dawson and Partners on behalf of Middle Aston Ltd to support the proposed redevelopment of Hatchery at Hatch End Industrial Estate.

The aim of this report is to document the findings of the investigation into energy efficiency measures and the feasibility of on-site decentralised and renewable or low carbon energy sources. The report makes recommendations as to the best means of incorporating low and zero carbon technologies into the development.

1.2 Description of the Site and Building

The development considered in this document comprises the redevelopment of existing storage, commercial buildings to provide 22 business/workshop units, 2 warehouse units and ancillary buildings, with car parking, cycle parking spaces.

For detailed description of the building, refer to the Planning statement.



Ground Floor Layout

Dynamic Simulation Model Visualisation

2 RELEVANT PLANNING POLICIES

This Energy Strategy responds to the broader set of National and Local policies outlined below.

2.1 National Planning Policy

The Government has set out a planning policy framework guidance in the National Planning Policy Framework (NPPF) (February 2019), within which planning authorities can prepare and apply their development plans. Fundamental to this guidance is the requirement to meet sustainable development objectives.

The NPPF covers a wide range of planning issues from promoting sustainable transport to facilitating the sustainable use of minerals. Climate change is covered in section 14 'Meeting the challenge of climate change, flooding and coastal change'. In summary the framework advises:

"Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

New development should be planned for in ways that:

- avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
- 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.

To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- 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."

Refer to : National Planning Policy Framework (2019) for further details.

2.2 Local Policy – The Cherwell Local Plan 2011-2031

2.2.1 Policy ESD 2: Energy Hierarchy and Allowable Solutions

B.184 Whilst we need to promote renewable energy where appropriate (see 'Policy ESD 3: Sustainable Construction'), it would be counter-productive to encourage generation of renewable energy if energy is being wasted by inefficiency. As such Policy ESD 2 expresses our support for an 'energy hierarchy'.

B.185 An Energy Statement will be required for proposals for major residential developments (over 10 dwellings), and all non-residential development to demonstrate how the energy hierarchy has been applied. The Energy Statement can form a standalone document or be part of the Design and Access Statement. The Council will produce a template for use in preparing energy statements

B.186 Carbon emissions reductions can be achieved through a range of "allowable solutions"; measures which secure carbon savings off site. These have yet to be defined by the government but could potentially include investment in off site low and zero carbon technologies. The concept is relatively new and is seen as a way to enable developments to become carbon neutral where it is not possible to deal with all carbon emissions through on site measures. It will not always be cost effective or technically feasible to meet the zero carbon standard through on site measures and the government is therefore proposing that the zero carbon standard could be achieved by mitigating the remaining emissions off-site through the use of allowable solutions. The Council will support the implementation of the national approach to allowable solutions once defined and any additional implementation guidance required at a local level will be set out in the Local Plan Part 2 and the Sustainable Buildings in Cherwell SPD'.

2.2.2 Policy ESD 3: Sustainable Construction

Policy ESD 3: Sustainable Construction

All new residential development will be expected to incorporate sustainable design and construction technology to achieve zero carbon development through a combination of fabric energy efficiency, carbon compliance and allowable solutions in line with Government policy.

Cherwell District is in an area of water stress and as such the Council will seek a higher level of water efficiency than required in the Building Regulations, with developments achieving a limit of 110 litres/person/day.

All new non-residential development will be expected to meet at least BREEAM 'Very Good' with immediate effect, subject to review over the plan period to ensure the target remains relevant. The demonstration of the achievement of this standard should be set out in the Energy Statement.

The strategic site allocations identified in this Local Plan are expected to provide contributions to carbon emissions reductions and to wider sustainability.

All development proposals will be encouraged to reflect high quality design and high environmental standards, demonstrating sustainable construction methods including but not limited to:

- **Minimising both energy demands and energy loss**
- **Maximising passive solar lighting and natural ventilation**
- **Maximising resource efficiency**
- **Incorporating the use of recycled and energy efficient materials**
- **Incorporating the use of locally sourced building materials**
- **Reducing waste and pollution and making adequate provision for the recycling of waste**
- **Making use of sustainable drainage methods**
- **Reducing the impact on the external environment and maximising opportunities for cooling and shading (by the provision of open space and water, planting, and green roofs, for example); and**
- **Making use of the embodied energy within buildings wherever possible and re-using materials where proposals involve demolition or redevelopment.**

Should the promoters of development consider that individual proposals would be unviable with the above requirements, 'open-book' financial analysis of proposed developments will be expected so that an independent economic viability assessment can be undertaken. Where it is agreed that an economic viability assessment is required, the cost shall be met by the promoter.

3 BREEAM

The District council's policy is for commercial developments to achieve a BREEAM rating of 'Very Good'.

The minimum percentage score to achieve a 'Very Good' rating is 55%. The current assessment has a targeted score of 61.41% whilst aiming to maximise every possible scoring opportunity within the limited scope of a development of this nature.

It should be noted that this pre-assessment only provides a guide to a possible route to achieving a BREEAM 'Very Good' rating and is not intended to be a binding approach to achieving a 'Very Good' rating. The predicted score and credits under each category are likely to change once the detailed assessment is undertaken as part of the detailed design stage.

The pre-assessment provided reflects the developer's intention to achieve a BREEAM rating of 'Very Good '. Given the design limitations of such a scheme it must be noted that nearly 12% of the predicted score falls under the purview and is dependent on the appointed contractor, site functionalities and available procurement routes at the point of construction.

For the detailed BREEAM pre-assessment please refer to appendix 3 of this report.

	Available	Weighting	Targeted
Management	15	12%	7
Health & Wellbeing	8	7%	4
Energy	13	9.5%	4
Transport	12	14.5%	5
Water	3	2%	2
Materials	14	22%	9
Waste	10	8%	6
Land Use & Ecology	13	19%	11
Pollution	6	6%	5
Exemplary	10		2
Total	104		55
Target Score	**61.41%**		

4 ENERGY DEMAND ASSESSMENT

4.1 National Calculation Methodology (NCM) and SAP

The baseline energy use and resulting carbon emission rate of the development has been assessed based on 2013 NCM methodology for the calculation of the regulated energy use such as the space heating and domestic hot water requirements. NCM results for unregulated energy are also identified for information.

The building has been modelled using IES Virtual Environment 2019 a Dynamic Simulation Software approved for generating Part L reports and Energy Performance Certificates.

Emissions within this report are based on the following CO_2 emission rates.

Natural Gas	0.216 kgCO_2/kWh
Grid electricity	0.519 kgCO_2/kWh
Grid displaced electricity	0.519 kgCO_2/kWh

5 ENERGY EFFICIENT DESIGN

5.1 Passive Design Measures

Compliance with the building regulations standard is achieved through energy efficiency measures alone.

The units are being constructed to a shell specification for fit out by the tenants. For the purposes of this energy assessment it is assumed that the units let as offices/research and development will be heated and cooled, with a small area set aside for toilets and kitchenette.

The industrial units are unlikely to be heated within the workshop areas, therefore it is assumed that 10% of the floor area of each unit will be will be set aside as for office and welfare facilities, which will be provided with space heating.

The design will target highly efficient U-values for windows and air tightness, opaque fabric element U values equal to or no worse than the limiting values. The values below include the thermal elements between the heated and unheated spaces of the Industrial units, which would be the boundary line for the emission rate calculation for the building control submission.

This assessment covers all regulated emissions from the whole development including the lighting within the storage areas, which would not be included within the Part L calculations.

	Limiting Values **Building Regulations, Part L1A 2013**	**Proposed Measures**
Air Tightness	10 m^3/hr per m^2	4 m^3/hr per m^2
External Wall U-Value	0.35 W/m²°K	0.2W/m²°K
Internal wall (administration area to storage areas) U-Value	0.35 W/m²°K	0.35 W/m²°K
Ground Floor	0.25 W/m²°K	0.25 W/m²°K
Glazing U-Value	2.2 W/m²°K	1.4 W/m²°K
Glazing G-Value	-	0.5
Glazing LT	-	0.7
Roof		0.16 W/m²°K

5.2 Heating

An air source heat pump is proposed to serve the office units and administration areas within the warehouses supplemented with electric panel heaters. As heat pumps are considered a renewable technology, for comparison purposes the energy efficient model incorporates a 93% efficient gas fired boiler and LPHW heating system in all zones.

5.3 Ventilation

The administration areas in the warehouses and the office units are assumed to be mechanically ventilated using supply and extract ventilation system with a specific fan power no worse than 1.0 W/l/s, and heat recovery device at least 75% efficient.

Local extract fans will be provided for toilet and tea point ventilation with specific fan powers no greater than 0.3W/l/s.

5.4 Cooling

Cooling will be provided to the reception via a reverse cycle heat pump system with a SEER no less than 6.0.

5.5 Domestic Hot Water

Domestic hot water is responsible for less than 1% of the regulated emissions, however to minimise any losses storage will be kept to a minimum through the use of point of use electric heaters, with time controllers, and insulated pipework to outlets.

5.6 Lighting

In all areas the lighting will have a minimum efficacy of 95Ll/cW with presence detection controls throughout.

5.7 Equipment

Equipment energy use or unregulated energy includes all the appliances, computers, and any electrical device belonging to the tenant and is excluded from the CO_2 reduction calculation.

5.8 Summary of Carbon Emissions Following Energy Demand Reduction

The annual energy consumption for the development incorporating the energy efficiency measures described above is as shown in the tables below:

Energy Consumption for baseline building		
Item	**kWhrs/m²/ Year**	**kWhrs/ Year**
Heating (gas)	47.5	115,154
DHW (gas)	3.1	7,557
Cooling	2.6	6,371
Auxiliary Energy	1.6	3,973
Lighting	19.8	48,033
Equipment	37.5	90,786
Total	**112**	**271,874**
Total no Equip	**75**	**181,088**

Energy Consumption for energy efficient building		
Item	**kWhrs/m²/ Year**	**kWhrs/ Year**
Htg	30.0	72,668
DHW	3.1	7,388
Cooling	1.1	2,664
Auxiliary Energy	2.4	5,862
Lighting	18.1	43,843
Equipment	36.0	87,129
Total	**91**	**219,554**
Total no Equip	**55**	**132,425**

Table 6: Carbon Dioxide Emissions from each stage of the Energy Hierarchy			
	Total Regulated Emissions	CO_2 Savings	Percentage Saving
	(Tonnes CO_2/year)	(Tonnes CO_2/year)	%
Part L 2013 Baseline	60		
Be Lean	52	8	13.6

The table above indicates that improvement over the baseline building by 13.6 % is achieved by the implementation of the energy efficiency measures for the development.

6 LOW & ZERO CARBON TECHNOLOGIES FOR ENERGY PRODUCTION

The development will not be able to get benefits from a communal heating system, therefore, the options available for renewable energy are considered, to meet the remaining target of carbon emissions reduction to satisfy national and local planning policies.

The use of energy conversion technologies using renewable energy must be analyzed. The main technologies available for on-site renewable energy generation are:

- Biomass
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Photovoltaic Panels
- Solar Thermal Hot Water Generation
- Wind
- Combined Heat and Power (CHP)

Refer to appendix 2 for more details and a brief explanation of renewable energy technologies.

6.1 Preliminary Technology Appraisal

Technology	**Feasibility***			Comments
	H	**M**	**L**	
Biomass			✓	The building heat demand could be intermittent, which is not suitable for a biomass boiler which has a relatively long heat up period, and operates at greater efficiencies when operated for extended periods.
Ground Source heat pumps			✓	Ground source heat pumps extract heat from the ground, and converts it to low grade heat for space heating and hot water. Despite the wider adoption of ground source heat pumps, the cost of installing bore holes or slinky installations can still be prohibitively expensive.
Air Source Heat Pumps	✓			Air source heat pumps extract heat from the air and converts it to low grade heat for space heating. Air source heat pumps are generally more cost effective than ground source heat pumps, and when installed as part of a reverse cycle heat pump installation providing comfort cooling the additional cost is relatively low. Air source heat pumps would be suitable for the units and only provide heating when there is a demand.

Technology	Feasibility*			Comments
	H	M	L	
Photovoltaic Panels		✓		Photovoltaic modules convert daylight directly into DC electricity and can be integrated into buildings. Space is available at roof level to install a PV array, which would make a considerable reduction from the predicted building emission rate, however, the small size of the majority of the units and diversity of use has the potential to lead to high installations costs at reduced benefit to the tenants.
Solar Hot water			✓	Solar thermal installations are a well established renewable energy system and can be one of the most cost-effective renewable energy systems available. Solar thermal systems are not viable for this site due to the low domestic hot water demand.
Wind			✓	The urban environment and the close proximity of dwellings are not favourable conditions for the installation of wind turbines. The uneven air flow caused by surrounding buildings and the potential negative impact on the visual and noise amenity of the area militate against the use of wind turbines for this development.
Combined Heat and Power (CHP)			✓	The extremely low heat demand of the building means a system that can be connected to heat network is not viable in this instance and is not proposed. It is also not feasible to install a local CHP due to the small heat demand of the site, and is therefore not recommended

H - High Feasibility - No Obvious restrictions

M - Medium feasibility - Significant issues that need to be addressed

L - Low feasibility – Site unlikely to support technology

Based on this preliminary evaluation, the following technologies will be assessed:

- Air source heat pumps

6.2 Air Source heat Pumps

6.2.1 Application

The technology makes use of the energy available in the ambient air. Essentially, heat pumps take up heat at a certain temperature and release it at a higher temperature. This is achieved by means of a simple heat exchanger in the case of air source heat pumps.

The efficiency of any type of heat pump is very much dependent on the temperature level at which it has to provide the heat: the lower the temperature level, the better the coefficient of performance.

Almost all heat pumps in operation are based on the vapour compression cycle, which combines efficiency, safety and reasonable cost. The efficiency of heat pumps is measured by the ratio of the heating capacity to the power input, referred to as the Coefficient of Performance (COP). A seasonal COP of around 400 is achievable from a variable refrigerant flow system.

6.2.2 Constraints

The following constraints have been identified for the application of air source heat pump technology at the site.

1. Space needs to be allocated for the heat pumps in a location that provides a good air flow through and around the units.

6.2.3 Emissions Reduction

Remodelling the building, exchanging the gas fired heating plant assumed within the energy efficient models with air source heat pumps with an SCOP of 400 will reduce the emissions by 8% from the energy efficient model.

Whilst the heat generated is from a renewable source, installations that also provide cooling do not qualify for payments under the Renewable Heat Incentive. However, providing good quality plant is specified and correctly installed the plant should qualify for the Enhanced Capital Allowance scheme.

6.2.4 Conclusion

Air source heat pumps are a viable technology for the office units, where installed as part of a reverse cycle refrigeration system providing both space heating and cooling.

Cooling is not proposed within the industrial units and these space air to water heat pumps would be a viable heat source.

Regulated emissions from Energy Efficient model ($kgCO_2$/yr)	Regulated emissions with air source heat pumps ($kgCO_2$/yr)	CO2 reduction % after Energy Efficiency measures (based on total regulated emissions)
51,576	45,132	11%

6.3 Emissions Following the Introduction of Renewable Technologies

The effect of the renewable technologies for the building as described above is to reduce the building regulated emissions by 11% below the energy efficient model and 24% below the baseline model as detailed in the tables below.

Energy Consumption for energy efficient Building with renewables		
Item	**kWhrs/m²/ Year**	**kWhrs/ Year**
Htg	14.0	33,936
DHW	2.8	6,879
Cooling	1.2	2,907
Auxiliary Energy	2.9	7,049
Lighting	15.0	36,261
Renewable Energy	0.0	0
Equipment	37.5	90,786
Total	**73**	**177,818**
Total no Equip	**36**	**87,032**

Table 6: Carbon Dioxide Emissions from each stage of the Energy Hierarchy			
	Total Regulated Emissions	**CO_2 Savings**	**Percentage Saving**
	(Tonnes CO_2/year)	**(Tonnes CO_2/year)**	**%**
Part L 2013 Baseline	60		
Be Lean	52	8	13.6
Be Green	45	6	10.8

7 RECOMMENDATION

Following a review of the relevant National, and Local Planning Policies, this Energy Assessment proposes a strategy that positively responds to the policy structure that requires developments to *be energy efficient and reduce building emissions.*

Energy efficiency measures will be implemented to provide a carbon saving of 13.6% in comparison to the Target Emission Rate regulated emissions. The energy efficiency measures include: good fabric insulation, improved air tightness, and low energy light fittings with presence detection.

The office units and administrative areas within the warehouses units will be heated via air source heat pumps which will reduce the emissions by 6 tonnes or a CO_2 reduction of 11% emissions reduction below the energy efficient model.

The total CO_2 reduction based on regulated emissions will be 24.4%.

Table 6: Carbon Dioxide Emissions from each stage of the Energy Hierarchy			
	Total Regulated Emissions	CO2 Savings	Percentage Saving
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Part L 2013 Baseline	60		
Be Lean	52	8	13.6
Be Green	45	6	10.8
Cumulative Saving		15	24.4