

BILLINGHURST BUSINESS PARK

Energy Statement

Fowler Clark Limited

www.fowlerclark.com

Telephone +44 (0)7815 908084

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Author: RT

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Billinghurst Business Park

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1.0 EXECUTIVE SUMMARY

Analysis has been carried out to determine the optimum energy strategy for the proposed new Billinghurst Business Park development. This has been completed with consideration to standards set by Horsham District Council and Part L of the Building Regulations.

The key efficiency measures for the scheme are summarised below:

- Highly efficient building fabric
- Mechanical ventilation with heat recovery
- Air source heat pumps
- Roof mounted photovoltaic panels

The energy strategy has been developed in line with planning policies, using strategies commonly used for building regulations compliance. As a result, it is understood that all relevant standards have been met.

2.0 INTRODUCTION

2.1 Description of the Project

The scope of the project is for a new mixed-use development containing both dwellings and commercial units, as illustrated below:



Figure 1 - Development Site Plan¹

¹ 2284-100-DR-L-101-S01 - Illustrative Masterplan - Local Extent

A mixture of dwelling types are to be provided including; apartments, detached, semi-detached and terraced houses.

Five industrial & logistics units are planned for the Southern end of the development. These will typically feature a combination of conditioned office and staff areas, alongside the industrial / storage facilities.

2.2 Purpose of Report

This report details the decision-making process used to identify the most appropriate energy strategy for the development.

3.0 ENERGY & CARBON CRITERIA

3.1 Horsham District Council

Horsham District Council's Planning Framework contains Policy 36 which addresses Energy Use²:

“Policy 36

Strategic Policy: Appropriate Energy Use

Energy hierarchy

All development will be required to contribute to clean, efficient energy in Horsham based on the following hierarchy:

- 1. Lean – use less energy – e.g. through demand reduction*
- 2. Clean – supply energy efficiently – e.g. through heat networks*
- 3. Green – use renewable energy sources*

District Heating and Cooling

Commercial and residential developments in Heat Priority Areas or the strategic development locations will be expected to connect to district heating networks where they exist using the following hierarchy, or incorporate the necessary infrastructure for connection to future network.

Development should demonstrate that the heating and cooling systems have been selected in accordance with the following heating and cooling hierarchy;

- 1. Connection to existing (C)CHP distribution networks*
- 2. Site wide renewable (C)CHP*
- 3. Site wide gas-fired (C)CHP*
- 4. Site wide renewable community heating/cooling*
- 5. Site wide gas-fired community heating/cooling*
- 6. Individual building renewable heating*
- 7. Individual building heating, with the exception of electric heating*

All (C)CHP must be of a scale and operated to maximise the potential for carbon reduction. Where site-wide (C)CHP is proposed, consideration must be given to extending the network to adjacent sites.

² Horsham District Council, Horsham District Planning Framework, November 2015

Energy Statements

All applications for residential or commercial development must include an Energy Statement demonstrating and quantifying how the development will comply with the Energy Hierarchy.

Developments in Heat Priority Areas and strategic developments should demonstrate and quantify how the development will comply with the heating and cooling hierarchy. Horsham District Council will work proactively with applicants on major developments to ensure these requirements are met.

Renewable energy schemes

The Council will permit schemes for renewable energy (e.g. solar) where they do not have a significant adverse effect on landscape and townscape character, biodiversity, heritage or cultural assets or amenity value. Community initiatives which seek to deliver renewable and low carbon energy will be encouraged.”

3.2 Building Regulations Part L

Part L is the appropriate section of the building regulations for carbon emissions. For the residential elements of the scheme, Part L Volume 1 (2021) applies. The commercial units would need to follow Volume 2.

The compliance criteria are detailed below:

3.2.1 Carbon Emissions

To demonstrate compliance, the calculated carbon emissions from the proposed building (Building / Dwelling Emission Rate) must be below a certain limit. This limit is established from a “notional building” which mirrors the same form as the actual building but follows set parameters for efficiency standards. This limiting emissions rate is referred to as the Target Emission Rate (TER).

So for compliance:

- *Domestic:* $Dwelling\ Emission\ Rate\ (BER) \leq Target\ Emission\ Rate\ (TER)$
- *Non-Domestic:* $Building\ Emission\ Rate\ (BER) \leq Target\ Emission\ Rate\ (TER)$

3.2.2 Primary Energy

Primary energy accounts for the inefficiency associated with extracting a fuel, processing it and delivering it to the site. In addition to a target for carbon emissions, Part L 2021 also features a condition that the proposed building has a lower primary energy rate than the notional building:

- *Domestic:* $Dwelling\ Primary\ Energy\ Rate\ (DPER) \leq Target\ Primary\ Energy\ Rate\ (TPER)$
- *Non-Domestic:* $Building\ Primary\ Energy\ Rate\ (BPER) \leq Target\ Primary\ Energy\ Rate\ (TPER)$

3.2.3 Fabric Energy Efficiency (Domestic Only)

For dwellings only, the regulations also provide a target that is specific to the building fabric. Here there is no consideration given to renewable technologies and building services.

The performance of the building fabric is considered by assessing the space heating (and cooling) demand. These are measured in kWh/m², for compliance the following needs to be met:

- *Domestic:* $Dwelling\ Fabric\ Energy\ Efficiency\ (DFEE) \leq Target\ Fabric\ Energy\ Efficiency\ (TFEE)$

Improvements with this metric can only be gained by adjusting inputs specific to the building fabric.

4.0 ENERGY HIERARCHY

In accordance with planning guidance, the strategy has been developed in accordance with the energy hierarchy.

4.1 Be Lean – Use Less Energy.

In the first instance demand reduction has been considered, energy efficient building fabric is proposed for the scheme along with an appropriate glazing provisions.

To further minimise heating demand, mechanical ventilation with heat recovery is proposed for the dwellings and appropriate elements of the commercial units.

4.1.1 Be Clean – Supply Energy Efficiently.

Be Clean refers to use of Combined Heat and Power (CHP) systems or district heating networks. In recent times CHP systems have decreased in popularity due to their reliance on fossil fuels. Biomass is an exception; however, the fuel is derived from timber which has significant supply chain issues. As a result, heat networks have not been considered appropriate for this scheme.

4.1.2 Be Green – Use Renewable Energy Sources.

A range of renewable technologies have been considered for the scheme. A detailed analysis is contained in Appendix A.

A combination of Air Source Heat Pumps (ASHPs) with Photovoltaic Panels are proposed. Further details are provided in the following section.

5.0 ENERGY STRATEGY - DWELLINGS

5.1 Heating & Hot Water

A number of options have been considered for providing the dwellings with heating and hot water. In keeping with recent trends, the intention is for the scheme to be fossil fuel free. This has been addressed in the development of the energy strategy. Effectively there are two fuel options to achieve this:

- Biomass
- Electricity

Using biomass for the site would introduce a number of complications with regards to fuel supply, storage and the maintenance of the boilers and feed systems. As a result, the use of electricity has been considered much more favourable.

Direct electric heating would be very simple, however the costs to occupants are a concern, so this is only considered for areas with limited heat demand. This steers the energy strategy towards the use of heat pumps.

The lack of a nearby water source prevents the use of a water source heat pump, leaving a choice between ground and air source.

Ultimately Air Source Heat Pumps (ASHPs) were identified as the preferred option due to their simpler infrastructure requirements.

The proposed development contains dwellings with a range of different heat loss characteristics. For example, detached houses are likely to have a fundamentally higher heat demand than mid-floor apartments. This will impact on the optimum air source heat pump configuration and design.

5.1.1 Air Source Heat Pump Configuration

There are a number of ways to implement ASHP technology which are discussed below.

5.1.1.1 Higher Heat Demand Dwellings

Higher heat demand dwellings would most likely be suited to a single (air-to-water) ASHP providing heating and hot water. Typically, an outdoor unit would be used with this configuration. The delivery system would be similar to traditional central heating with radiators or underfloor heating.

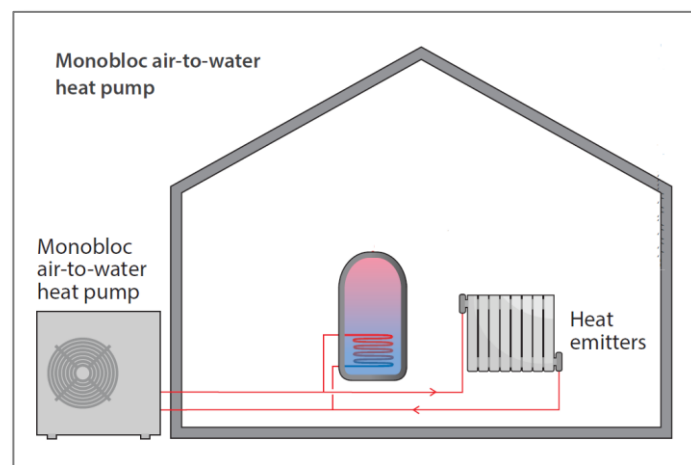


Figure 2 - Typical Air to Water Heat Pump Configuration with External Unit³

³ BSRIA BG 34 / 2021 Illustrated Guide to Renewable Technologies

5.1.2 Low Heat Demand Dwellings

Dwellings with low heat demand may be best suited to direct electric heating (panel heaters) with a heat pump water heater. This would avoid potential issues with a single heat pump over-cycling as the heating and hot water demand are mis-matched. The low space heating demand would also minimise the running cost of the direct electric heating.



Figure 3 - (Left) Heat Pump Water Heater (No External Unit Required)⁴ , (Right) Typical Electric Panel Heater⁵

⁴ <https://www.energreen.be/stocker-son-energie/boiler-thermodynamique/vaillant>

⁵ <https://www.victorianplumbing.co.uk>

5.1.3 Apartments

For apartments, suitable locations for external units are limited. So, the preference would be to use a heat pump configuration that avoids these.

This arrangement shown in Figure 3 above, offers a potential solution.

Alternatively exhaust air heat pumps are becoming increasingly popular for apartments. These can integrate heating, hot water and mechanical ventilation into a single unit.

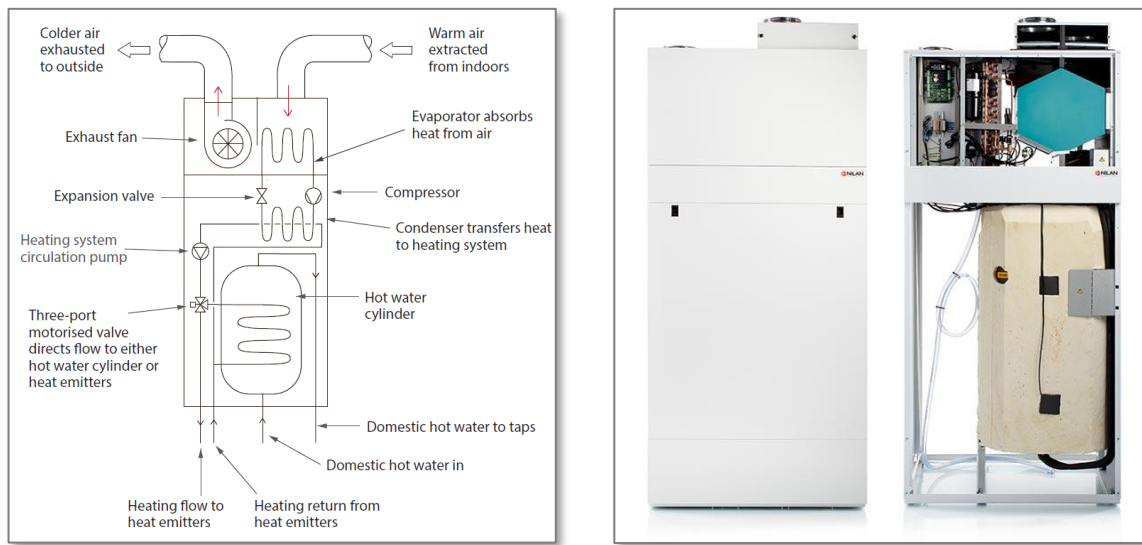


Figure 4 - Exhaust Air Heat Pump Configuration

5.2 Ventilation

Mechanical Ventilation with Heat Recovery (MVHR) will be considered for the scheme to help meet the energy and carbon targets.

5.3 Lighting

High efficiency LED lighting will be provided across all the dwellings.

5.4 Photovoltaic Panels

Considering the dwellings are intended to be all electric, photovoltaic panels would complement this strategy. As a result, these are proposed for the pitched roofs that are appropriately orientated. The ability to maximise on-site consumption with the use of a Solar-Sharing system will be considered for the scheme.

6.0 ENERGY STRATEGY - COMMERCIAL UNITS

6.1 Heating & Hot Water

As with the dwellings Air Source Heat Pump (ASHP) technology is also favourable for the commercial units. For office type spaces the intention is to use an air-to-air configuration which allows for both heating and cooling. As illustrated below this set up involves a combination of indoor and outdoor units linked with refrigerant pipework.

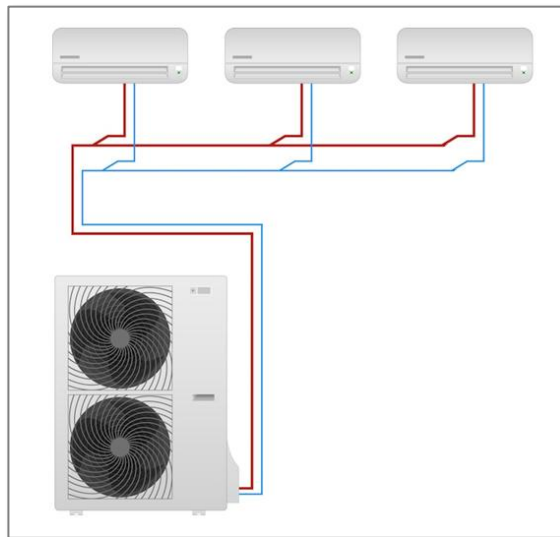


Figure 5 - Air-to-Air heat pump arrangement.

For spaces with low heat demand and no requirement for heating, electric panel heaters are proposed.

The commercial units aren't anticipated to have high hot water demand, so the intention is to use simple direct electric point of use water heaters. This avoids any losses associated with storing and recirculating a large volume of hot water.

6.2 Ventilation

Mechanical Ventilation with Heat Recovery (MVHR) is proposed for the occupied areas. For the large logistics type spaces, it is anticipated that natural ventilation via large roller-shutter doors will be sufficient for most end uses.

6.3 Lighting

High efficiency LED lighting will be provided in all areas. In addition to this further energy savings will be delivered via the controls strategy as detailed below:

Space Type	Control Strategy
Office	Absence Detection with Daylight Dimming
Circulation	Presence Detection
WCs	Presence Detection
Stores	Presence Detection
Warehouse	Daylight Dimming

Table 1 Commercial Unit Proposed Lighting Controls

6.4 Photovoltaic Panels

As with the dwellings, photovoltaic panels are proposed for the roof spaces of the commercial units. The exact sizing will be confirmed at detailed design stage and aim to achieve a suitable balance between generation and export.

7.0 CONCLUSIONS

An energy strategy for this site has been prepared to address both planning and building regulations requirements, as detailed below:

7.1 Horsham District Council Requirements

The energy strategy has been developed in accordance with the lean, clean, green energy hierarchy. The proposed design is completely free of fossil fuels, and as the electricity grid is progressively decarbonised the operational carbon emissions will diminish. As a result, it is understood that planning policy 36 has been met.

7.2 Building Regulations

For both the domestic and commercial elements of the scheme, strategies are proposed that are consistently used to comply with Part L (2021) of the building regulations.

8.0 REVIEW OF LOW CARBON TECHNOLOGIES

LZC Technology	Basic Technical Information	Technical, Environmental & Economic Implications/Considerations	Suited Application	Site Specific Comment	Considered for Detailed Analysis
Solar Thermal	Solar collectors (flat plate or tube) transfer energy into transfer liquid to a closed loop twin coil hot water cylinder.	• Can meet a significant proportion of the DHW demand • Requires considerable hot water demand all year round to be beneficial • Efficiency effected by site factors: shading, orientation etc.	Domestic and commercial applications with high annual hot water load; leisure centres, canteens, washrooms.	The popularity of solar PV has caused a significant decline in implementation and support for solar thermal. Hot water demand is anticipated to be low.	No
Wind Turbine	Turbine/ generators convert wind energy to electrical power.	• Allows on site generation of renewable electricity • Not suited for urban environments • Can create structural, vibrations and noise implications • Costs can be high in relation to the actual amount of electricity generated • Potential planning issues • Generally long paybacks	Large sized turbines in non-urban or offshore locations are often most effective.	Current policies support the development of large-scale offshore wind farms or dedicated onshore wind projects. Integration of wind turbines into individual building developments are rarely favourable at present.	No
Solar Photovoltaic	Converts sunlight to electrical power.	• Allows on site generation of renewable electricity • Low maintenance requirements • Efficiency effected by site factors: shading, orientation etc.	Wide range of building types particularly buildings with limited solar shading and south facing roofs.	Buildings have large roof areas with minimal shading.	Yes
Air Source Heat Pump (ASHP)	ASHPs capture heat from the outside air for use within the building.	• Lower installation cost than ground source heat pump • Can provide heating and cooling • COP is not as good during the heating season when the outside air is often cooler than the ground	Wide range of building types particularly building designed to have low temperature heat emitters.	Technology could be used for both dwellings and commercial units.	Yes
Ground Source Heat Pump (GSHP)	GSHPs capture heat from the ground for use within the building.	• More heat is supplied to the building than energy is consumed by the heat pump • COP is much better than air source heat pumps • Requires area for ground collector or boreholes • High initial capital cost	Wide range of building types particularly building designed to have low temperature heat emitters and sufficient space for necessary ground works.	External space is relatively limited, and installation is more complex than air source.	No

LZC Technology	Basic Technical Information	Technical, Environmental & Economic Implications/Considerations	Suited Application	Site Specific Comment	Considered for Detailed Analysis
Water Source Heat Pump (WSHP)	WSHPs work in a similar way to GSHPs except water is used for the heat source.	• More heat is supplied to the building than energy is consumed by the heat pump • High COP • Can be closed or open loop • High initial capital cost	Buildings near to reliable sources of water. Particularly suited to buildings designed to have low temperature heat emitters and sufficient space for necessary ground works.	Significant water sources are a considerable distance from the site.	No
Biomass	Uses biomass as a fuel source for heat generation.	• Renewable source of heating • Requires large fuel storage capacity • Generally, a large capital cost	Building/site with sufficient access and storage facilities and a capable maintenance team/infrastructure in place.	This technology is now close to obsolete due to a combination of wider heat pump use and very high fuel prices due to global supply chain issues.	No
Combined Heat & Power (CHP)	Generates both electricity and heat using fossil or renewable fuels.	• Efficient transportation and use of heat for a wide variety of users • Fuel flexibility • Dramatically increasing fuel efficiency through use of CHP • Can requires extensive infrastructure network if not already in place • Large plant space required	Large project with 24hr base load, typically suits hotels, hospitals and, leisure centres.	This technology is now close to obsolete due to limitations of the fuels to power it. Fossil fuels have unacceptably high CO₂ emissions, and biomass has cost and supply chain issues.	No

Table 2 - Review of Low Carbon Technologies