QODA

11 Belbroughton Road

MEP Services Planning Report

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QODA

Revision Summary

QODA

Contents

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1 Introduction & Summary

QODA Consulting have been engaged to undertake the M&E services design for 11 Belbroughton Road. The property is a ~1920's 3 storey building within Summertown and has a side extension constructed in 2001. The property is a mixture of solid brick construction and modern cavity wall construction.

This document provides details for the M&E design proposals influencing planning considerations for the scheme. This includes the ASHP system, location, size, dimensions, and noise considerations. PV panels have also been proposed.

The property is proposed to be refurbished and improved and new extensions added to the rear of the property.

The new extension to the rear will benefit the fabric of the structure since the new rear extension will cover the existing solid wall construction to improve the insulation performance. The exisitng windows are also due to be replaced with new.

QODA has reviewed the scheme and has assessed the building for improving the services for the site. The space heating, hot water and power supplies have been reviewed.

To summarise the findings, the analysis has concluded that an Air Source Heat Pump installation in concert with PV mounted roof panels would provide a sensible and efficient and practical low carbon solution for the site.

The initial design investigations also highlighted noise as a consideration for ASHP operation and this has been analysed in the report. To summarise, a thoughtful design proposal has been put forward with a focus on minimising the noise breakout to the neighbours' properties and surrounding areas. The target is to significantly undercut the standards for external breakout noise limits.

The PV panel proposals were also evaluated against the existing annual energy use for the site and it was calculated that they would contribute circa 18% to the house based on the existing annual heating and hot water load. This is a positive result and validates the provision of PV for the scheme, improving the ASHP efficiency, providing an excellent sustainable proposal and reducing the carbon emissions for the site.

2 Design Criteria

This report gives an overview of the mechanical services that are best suited for the dwelling, 11 Belbroughton Road. All strategies have been investigated to provide the best possible outcome for the property. By doing this we can plan appropriately for the next stages of this project, making sure it is compliant with building standards/regulations and to the clients' needs.

The design criteria will be in accordance with the recommendations of the following:

CIBSE Guides
Statutory undertakings
Building Regulations
Building Standards

2.1 Building Regulations

Part L2 of the UK building regulations sets requirements for the conservation of fuel and power in dwellings.

Part F of the UK building regulations sets requirements for ventilation provisions for air quality.

Part O of the UK building regulations sets out the overheating of buildings requirements.

There is no specific requirement for carbon emission rate of the dwelling however, an assessment using the Standard Assessment Procedure (SAP) 2012 must be carried out to calculate energy performance, EPC ratings of the proposed dwelling and the associated carbon emissions. The energy and heat losses of the building will be finalised at the next stage.

2.2 Building Services

The building services will be developed to supply the needs of the building at minimum energy consumption during the next stage of design. This will include:

Strategically places systems to reduce index runs.
Intelligent controls for heating and hot water
Renewable energy technologies

3 Sustainability Statement

The sustainability strategy consists of Solar Photovoltaic panels on the roof that support the ASHP located at the rear of the property. The space heating and domestic hot water will be served by an Air Source Heat Pump Installation. The solar PV panels will provide electrical power that will serve the dwelling first, and any further excess power generated will be exported to the grid.

This is a sensible and practical approach to provide renewable and sustainable energy to serve the property without excessive complexity and with practicality in mind. The PV panels have been assessed from a practicality and efficiency perspective and provide good utilisation factors on the proposed roof area. The ASHP has been carefully selected and located taking into consideration the surrounding properties and the building owner. It is also located as close to the property as practicable for efficiency reasons.

The PV and ASHP proposals have been analysed and are summarised in the report.

4 Mechanical Services

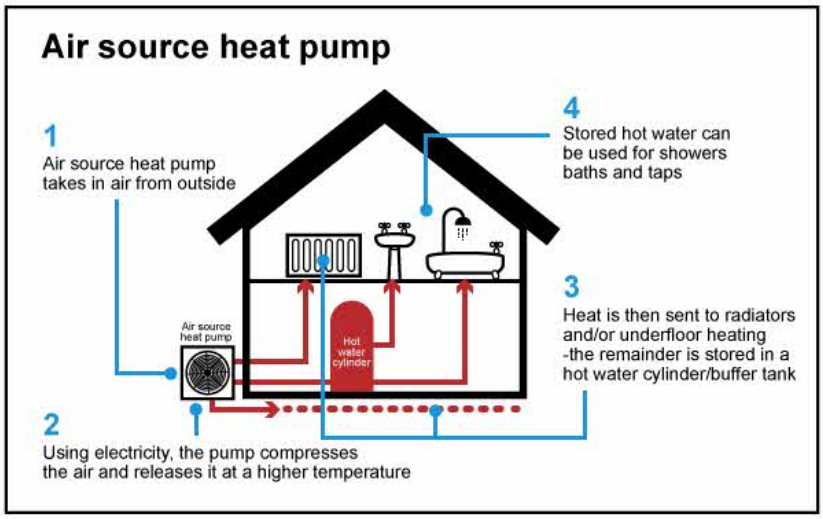
4.1 Heat Generation Options

Due the Clients aspirations for a low carbon building, the lack of a local gas supply and future regulations banning the use of gas or oil boilers in new dwellings, use of heat pump technologies has been discussed as the right solution for the heating and hot water requirements for this project.

There is a range of types of heat pumps including Exhaust Air Heat Pumps (EAHP), Ground Source Heat Pump (GSHP) and Air Source Heat Pump (ASHP). The EAHP has been discounted due to insufficient performance and impractical. The GSHP has been analysed and omitted due to practical site challenges and considerations and internal space requirements. The Air Source heat pump was chosen because the system is more compact, and it can fit outside of the property with the least amount of disruption to the property and neighbours during its installation and operation and it provides a high efficiency.

An Air Source Heat Pump (ASHP) is proposed for space heating and hot water for the house. Air source heat pumps (ASHPs) use the refrigeration cycle to extract heat from the outdoor air and transfer it into a heating fluid, normally water, for use in the building. The subsequent system is similar to a traditional boiler system combining heating and hot water into a single solution.

The heating system via an ASHP often utilises a lower flow and return temperature compared to a boiler system and as such lends itself to an underfloor heating system. Radiators are used within the system often to provide further heat to rooms where necessary.



In order to supply the dwelling adequately multiple units are required.

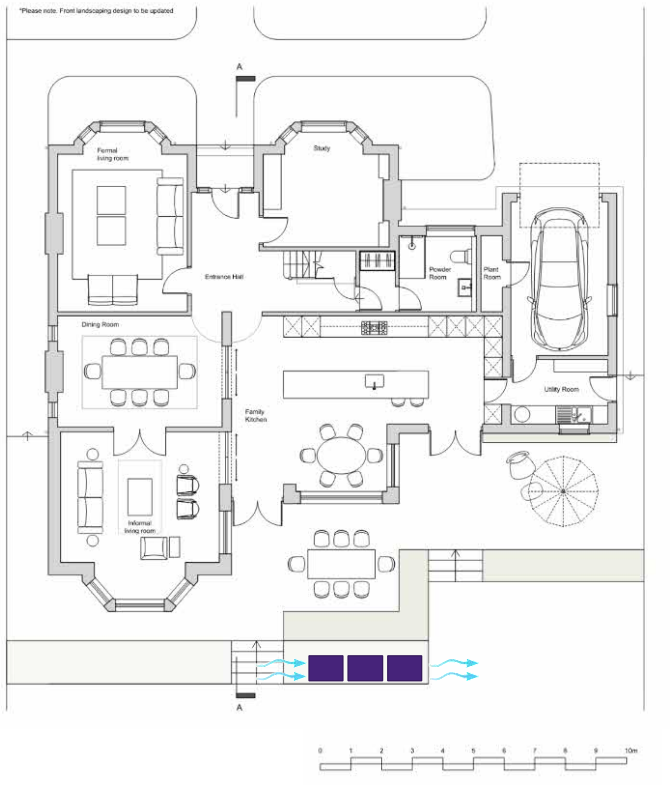
The ASHP units will be located to the back of the property due to insufficient space in the front. They will be incorporated into the design of the rear terrace and planters, to minimise the visual obstruction. The noise generated from the units can be attenuated accordingly.

Sufficient air flow will need to be available to the units and the units located with adequate space for installation and maintenance as per manufacturers requirements. All ASHP installations require slightly different installation and maintenance spaces however, most require approximately 1.5m to the front and 200mm to each side and 500mm to the rear of each unit.

4.1.1 Air Source Heat Pump Design

An ASHP with an output of 30kW (based on a 70W/m²) for the property is required to serve the house. In order to achieve this the following option is suggested:

1. 3 x aroTHERM air source heat pump 11kW
   Air-to-water heat pump
   Sound power as low as 66dB
   Flow temperature of up to 63°C
   Compact dimensions (H x W x D mm):
   975 x 1103 x 463 for each unit



Location of Air Source Heat Pumps on Ground Floor Drawing

Approx size of 11kW ASHP –

Supply Airflow -

Exhaust Airflow -

Approximate free air surrounding units:

1,500mm to the front
500mm to each side
700mm to the rear of each unit.

Approximate Total Space for units required:

H x W x D
1,300 x 5,000 x 2,500

Note – The type of unit is important to ensure the required airflow is from the sides and front rather than top-flow units. The space to the front of the unit can be the garden.

4.1.2 Air Source Heat Pump Noise Considerations

Air Source Heat Pumps can be noisy when in use therefore the appropriate precautions must be considered within the design. Acoustic enclosures and other noise mitigating technologies are often included within a design for clients or neighboring properties.

Levels from 3 units: 70 dB

Professional Practise Guidance on Planning & Noise – Supplementary Document 2: Good Acoustic Design (2017) states outdoor living areas should not exceed 55dB LAeq for a steady continuous sound.

The following neighbours would have an assumed reduction of approximately 20dB for the neighbour to the right 8m away and the neighbour to the left who is 9m away also, approximately 20dB. Both are approximately under 55dB LAeq.

In addition to these calculations, the design shall also incorporate louvers to the sides of the units for additional noise attenuation. This will improve the noise emissions to the neighbouring properties and to the property being served. The anticipated and targeted noise reduction shall be 55dB to the property being served. This means the neighbouring properties will be well within the noise limits. The anticipation is that this will reduce the noise breakout well below the standard external criteria and therefore satisfy the concerns over noise breakout to the neighbouring properties.

The proposed acoustic louvres shall be high performance screens to provide high acoustic attenuation yet still allow for high airflow rates. The proposed acoustic louvres are Caice Acoustic 300mm deep louvres. These provide high acoustic attenuation with good airflow performance.

It should be noted that the airflow free area and space requirements do need to be greater to allow for the required free area.

Approximate space allowance for louvres:

Sides 2500mm louvres
Front 5000mm louvre

4.1.3 Incentive

The property could be eligible for the 'Boiler Upgrade Scheme' if there is a valid Energy Performance Certificate (EPC) with no outstanding recommendations for fabric insulation. This entails a grant, in the region of £5000-£7500, from the government to cover part of the cost of replacing fossil fuel heating systems with a heat pump or biomass boiler.

4.2 Domestic water services

All domestic hot and cold services shall comply with Part G of the Building Regulations and Water Regulations.

4.2.1 Cold water

The property will be connected to the existing mains cold water supply where the incoming pipes using 35mm plastic pipes. This will service all new bathrooms.

4.2.2 Hot water

The cold water will be heated within a hot water cylinder via a combination of ASHP and immersion heaters. The ASHP will heat the hot water to a stored temperature of approximately 53-60°C, with a pasteurisation cycle to remove the legionella risks.

4.3 Drainage

To comply with Part H Building Regulations, all stacks will be ventilated at roof level, at suitable distances away from openable windows and above the occupied zone.

All drainage will connect to existing to provide adequate discharge from the house and have rodding access for maintenance and cleaning.

4.4 Ventilation

4.4.1 Mechanical Ventilation

4.4.1.1 WCs and Bathrooms

Intermittent or continuous extract ventilation will be provided to these room types and in line with Part F of Building Regulations. Where possible an MVHR system is preferred to ventilate bathrooms and WC accommodation where practicable.

4.4.1.2 Fireplaces

The open fireplaces will require combustion ventilation if retained. These will be developed with the specialists. Existing gas fireplaces to be confirmed if retained.

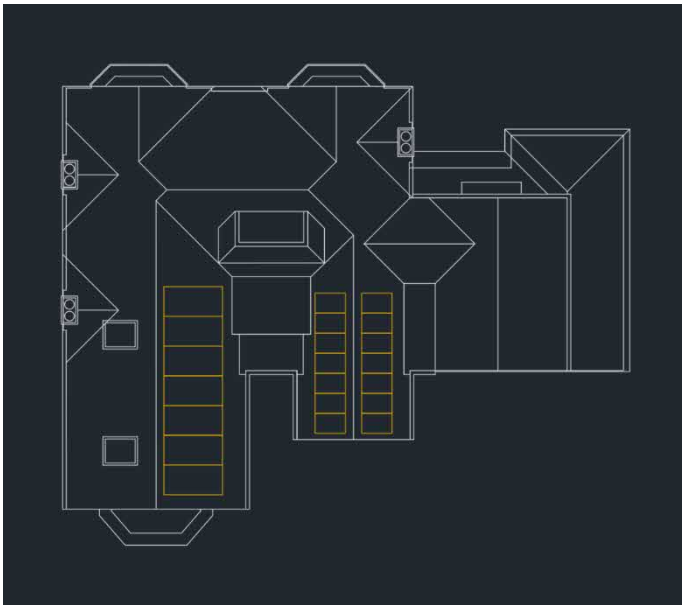
4.4.2 Natural Ventilation

Natural ventilation is available everywhere throughout the dwelling via to openable windows and trickle vents.

4.5 Solar Photovoltaic Panels

Solar Photovoltaic Panels generate electricity from the sun by using the properties of semi-conductor materials. Panels are the most common product which are mounted together, forming arrays. The DC electricity produced by the array is converted, by an inverter, into AC power for use within the building.

4.5.1 Solar PV Design



Suggested Solar PV Panels Position on Roof Plan

WEST FACING LEFT HAND SIDE

7 x 330W-24V Polycrystalline Solar Panels

Dimensions (H x W x D): 1956 x 992 x 40mm

Orientation: 40 degrees from the South

Inclination: 33-38 degrees from the horizontal

Estimated Annual output of this design: 2,166.78 kWh.

Price per panel: £245

Total Cost for panels: £1,715

(The cost was obtained via Dragons Breath Solar 2023 website)

WEST FACING RIGHT HAND SIDE

7 x 115W-12V Polycrystalline Solar Panels

Dimensions (H x W x D): 1015 x 668 x 30mm

Orientation: 40 degrees from the South

Inclination: 33-38 degrees from the horizontal

Estimated Annual output of this design: 755.09 kWh.

Price per panel: £112.45

Total Cost for panels: £787.15

EAST FACING RIGHT HAND SIDE

7 x 115W-12V Polycrystalline Solar Panels

Dimensions (H x W x D): 1015 x 668 x 30mm

Orientation: 40 degrees from the South

Inclination: 33-38 degrees from the horizontal

Estimated Annual output of this design: 755.09 kWh.

Price per panel: £112.45

Total Cost for panels: £787.15

Total Cost of Panels: £3,289.30

Total Estimated Annual Output: 3,676.96 kWh

5 Energy Evaluation

Annual Energy figures have been obtained from the house bills for the existing gas and electricity use for the site. This has allowed some estimates for future energy usage and to evaluate the effectiveness of the PV panels and proportion that they may be able to provide to the annual energy use.

It should be noted that the cost of energy has increased in 2023 and may change again moving forward into 2024.

COP3 ASHP Heating electric kWh input required: 14,409 kWh

The proposed Solar PV Panels would provide circa 18% of the required ASHP electrical load based on the existing building energy use. This is a positive fraction and validates the introduction of the PV panels. They will contribute positively to the carbon savings for the property over the year and improve the buildings sustainability credentials.

This evaluation will be progressed during detailed design for the formal energy calculations.