QODA

Petersfield Festival Hall

Assessment of Energy Efficiency Retrofit Options

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1 Executive Summary

This report details the energy modelling analysis undertaken by QODA Consulting on the Petersfield Festival Hall. The aim of the report is to allow Petersfield Town Council to make an informed decision on the extent of retrofit measures implemented, and how they will interact with new building elements and services.

The existing building has been modelled and the results compared to real-life utility bills to set an accurate benchmark for comparison.

Four improvement options were then modelled, with energy efficiency interventions varying from the minimum required by Building Regulations up to the Passivhaus Standard for retrofit, EnerPHit.

The analysis shows that more holistic interventions, those from Options 3 and 4, are required to have a realistic chance of achieving zero-carbon by 2035, the Council's stated aim. The building services, particularly the heating source, will also need to be upgraded to achieve this target, either now or during a future phase.

Based on the outcomes of the study, it is the opinion of the authors that the Council should pursue Option 4 with the appointed design team, and seek Salix funding to make this financially viable.

Proposed Elevation by Foster Wilson Architects

2 Purpose of Study

QODA Consulting were commissioned to carry out an energy study of the Petersfield Festival Hall. The building will undergo a thorough refurbishment and extension, so the Council wish to use this opportunity to improve its energy performance.

As part of the Petersfield Town Council Climate Emergency Strategy, the Council have committed to all council buildings being zero-carbon by 2035. The refurbishment and extension of the Festival Hall must therefore allow this to be achieved, either upon completion or following the implementation of a longer-term roadmap to zero-carbon outlined in this report.

The project is currently at RIBA Stage 3, where design proposals are being developed by the architect (Foster Wilson) and building services engineers (Skelly & Couch). The final design proposal will then be submitted for planning permission. The energy performance target of this proposal is currently undecided.

In addition to optimising the energy performance of new extensions and new building services, existing building elements will need to be upgraded. Without an analysis that quantifies the benefits of different measures it is difficult to decide on the best approach, so this energy study presents a number of options for consideration, quantifying both energy performance and lifetime carbon emissions. This will allow the Council and design team to select an option (or a combination of different options) to carry forward. Budgetary and other constraints will need to be considered, so indicative costs provided by the project Quantity Surveyor (Ainsleys) are included.

A "fabric-first" approach is widely regarded as the best way to achieve zero-carbon through a reduction in energy demand, and is therefore the focus of this report. The feasibility of achieving EnerPHit certification (Passivhaus for retrofit) is also assessed, as EnerPHit is the most advanced "fabric first" approach available.

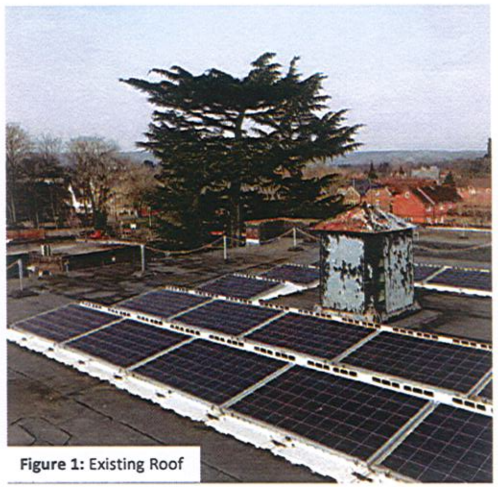


Figure 1: Existing Roof

3 Background & Site Survey

The Petersfield Festival Hall was originally built in 1935. Since then, a number of extensions and refurbishments have been carried out, principally in the 1970s and 1980s to the East, West and North. The South façade is the original 1930s construction. Insulation has also been added in various places, making for a complex overall picture of energy demand.

Understanding of the existing building is crucial to selecting appropriate upgrade recommendations. QODA therefore carried out a site survey on 8th March 2021 to gather information. The findings are detailed in Section 5 of this report.

Utility bills were also provided for the years 2017 and 2018, which give real-life energy consumption from both gas and electricity. Utility bills for areas of the building occupied by council tenants, the first floor of the northern side, were not available at the time of writing.

Figure 2: Existing masonry walls, 1930s (R) and others (L)

Figure 3: Existing 1930s Town Hall façade

4 Methodology

In order for the Council and Design Team to make an informed decision on energy efficiency improvements, energy modelling has been undertaken using Passivhaus Planning Package (PHPP) software. This software calculates a building's space heating demand in kWh/m^2.year, given various input parameters such as construction types, insulation thicknesses, window specification and airtightness (the rate at which air leaks out of a building, the lower the better).

Firstly, the existing building was modelled in PHPP to provide a baseline for comparison. The modelled space heating demand of the existing building aligns closely with the real-life consumption data provided by utility bills.

Four versions of the proposed building were then also modelled in PHPP, forming Options 1 to 4. The geometry is based on the latest architectural drawings provided by Foster Wilson. The specification of each option is incrementally improved from Option 1 through to Option 4. Full details of the specifications, energy consumption, and lifetime carbon emissions are provided in Sections 6 to 9 of this report.

When combined with the assessment of capital costs and other constraints, such as likely planning requirements, the 4 options provide sufficiently detailed information for a strategy to be selected and carried through to RIBA Stage 4.

An outline summary of the baseline and 4 improvement options is provided in Table 1, with details in the following sections of this report.

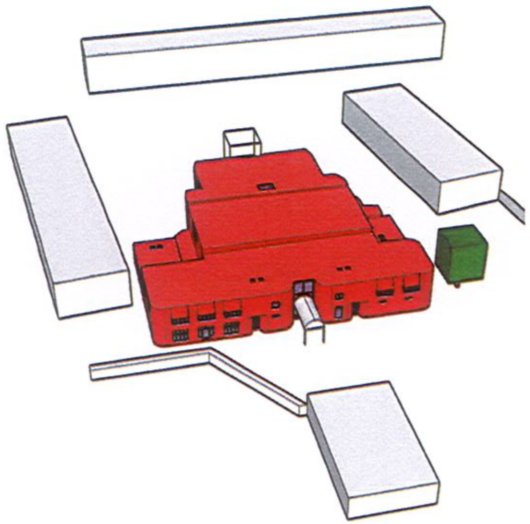


Figure 4: 3D representation of the existing site and shading objects

	Energy Strategy	
Baseline	• Existing building specification	
Option 1	• Replacement of single glazing with double glazing • Basic draught-proofing • Predominantly natural ventilation	• New elements built to limiting U-values of Approved Document Part L2B • Existing gas boilers retained
Option 2	• Limited thickness of Internal wall insulation to all existing walls • Replacement of all windows with double glazing • Predominantly natural ventilation	• Slightly improved performance of new elements • Existing gas boilers retained
Option 3	• External wall insulation to existing North and West facades • Limited thickness of Internal wall insulation to South façade (original 1930s) • Replacement of all windows with triple glazing • Mechanical ventilation with heat recovery throughout	• Additional insulation to all existing flat roofs • Significant airtightness improvements • Improved performance of new elements • Incremental replacement of existing gas boilers with air source heat pumps
Option 4	• External wall insulation to all existing facades • Replacement of all windows with triple glazing • Mechanical ventilation with heat recovery throughout • Additional insulation to existing flat roofs	• Further airtightness improvements • Insulation to existing ground floor slab • Further improvement to new elements • Gas boilers replaced with air source heat pumps

Table 1: Summary of proposals

5 Baseline – Existing Building

An analysis of utility bills and PHPP modelling have allowed an accurate picture of the existing building to be developed, for comparison with the subsequent improvement options.

5.1 Current Energy Consumption and Carbon Emissions

Gas and electricity bills provide detailed information on the current building performance. Due to the Covid-19 pandemic 2020 was an abnormal year, but complete data for both 2017 and 2018 was obtained.

The utility bill data is summarised in Appendix A using an average of 2017 and 2018. A monthly allowance for hot water use has been applied evenly throughout the year, assuming this is equivalent to the minimum monthly gas consumption when it is likely that no heating was used (July).

These utility bills do not include areas on the northern side of the first floor, occupied by Council tenants. The values are therefore normalised by the remaining treated floor area (TFA), 1566 m^2. As the energy model in section 5.2 does include these areas, those values are normalised by the total TFA, 1936 m^2.

Table 2 and Figure 5 show total energy consumption by end-use.

Table 2 also includes the existing 9.84 kWp solar photovoltaic (PV) system, which generates electricity for immediate use in the building or export to the National Grid. The average annual energy generation since installation in 2012 is therefore shown as a negative consumption. The second solar PV array has not been included as this serves the separate swimming pool.

It is clear that space heating makes up by far the biggest proportion of energy consumption (64%) and reducing this therefore represents the biggest opportunity for improvement. Given the usage of the building, it is also possible that the estimate of hot water consumption below is higher than is really the case, in which case the space heating demand is even larger than estimated, and potential savings even higher.

End-Use	Annual Energy Consumption (kWh)	Annual Energy Consumption (kWh/m²)
Space Heating (gas)	168,500	108
Hot Water (gas)	18,000	11
Cooling (electricity)	7,000	4
Other Electricity (appliances, lighting, office equipment, small power etc)	69,500	44
Solar PV (electricity generation)	-9,600	-5

Table 2: Current energy consumption by end-use

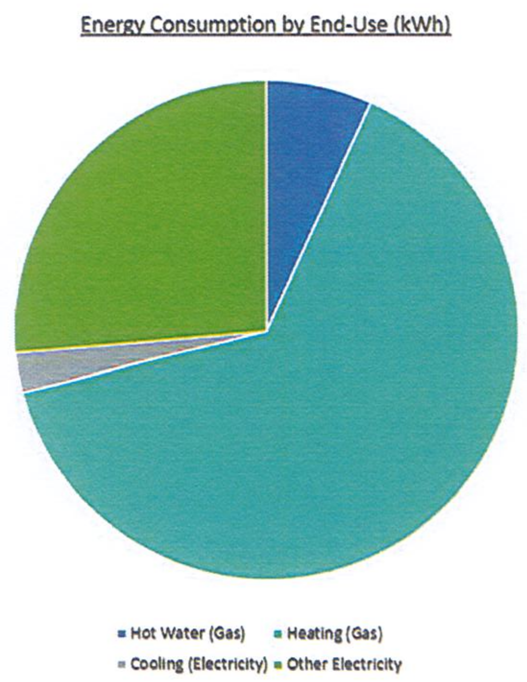


Figure 5: Current energy consumption

As a mixed-use building with variable occupancy, it is difficult to directly compare current consumption against industry standard benchmarks. However, the CIBSE TM46 benchmarks do provide some insight into what might be expected.

Building	Gas Consumption (kWh/m^2.year)	Electricity Consumption (kWh/m^2.year)
Petersfield Festival Hall	**119**	**48**
Office	120	95
Entertainment Hall	420	150
Public buildings with light usage	105	20

Table 3: Comparison of energy consumption with CIBSE TM46 benchmarks

Gas consumption aligns well with what would be expected from a typical office or lightly used public building. It is significantly lower than what would be expected in an Entertainment Hall, but this is almost certainly explained by infrequent use compared to a professional theatre with performances every day of the week.

Electrical consumption is lower than a typical office, probably due to low occupant density in the spacious Town Hall. It is also lower than the consumption expected in an Entertainment Hall for the reason described above, but is higher than a public building because of its use as an office space.

It is possible to calculate the building's current carbon dioxide emissions using emissions factors for each fuel type. These emissions factors can vary over time, so values over the next 60 years (until 2080) have been taken from the Treasury Green Book.

Broadly speaking, carbon emissions as a result of combustion of fossil fuels (gas in this case) will remain the same over time. However, carbon emissions arising from the use of electricity are shrinking quickly due to decarbonisation of the National Grid thanks to large-scale renewable energy production.

The solar PV system on the existing roof can be used to offset carbon emissions. For the purposes of this analysis, it is assumed that the existing solar PV system will be maintained or replaced over the next 60 years, although it is recognised that as technology evolves the output may well change.

Fuel Type	2021 CO_2 Emissions (tonnes CO_2)	Average Annual CO_2 Emissions 2021-2080 (tonnes CO_2)	Total Annual CO_2 Emissions 2021-2080 (tonnes CO_2)
Gas	34.3	36.1	2,167
Electricity	8.7	3.3	201
Existing Solar PV	-1.1	-0.4	-25
TOTAL	**41.9**	**39.0**	**2,343**

Table 4: Carbon emissions summary

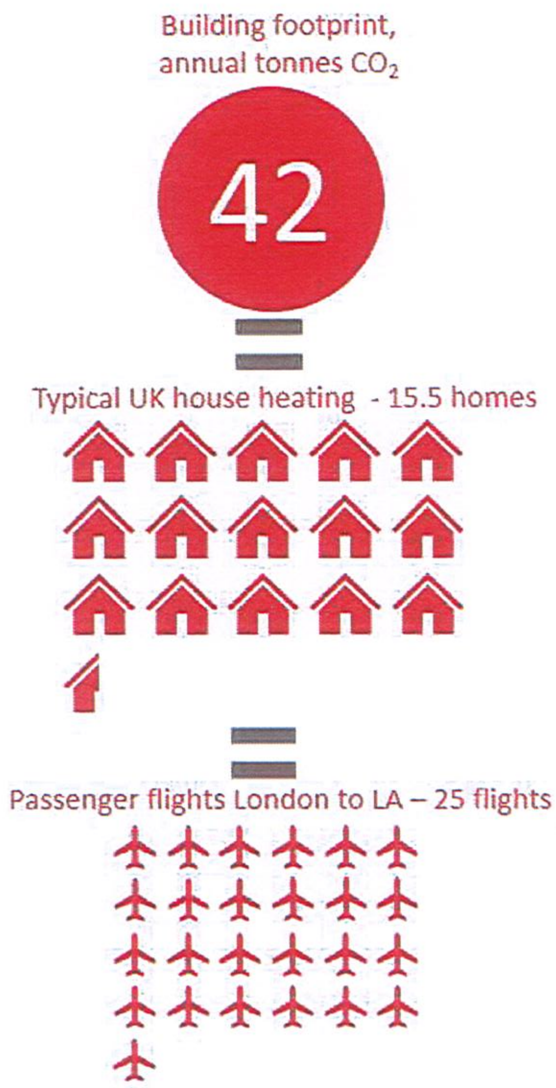


Figure 6: Current 2021 equivalent CO_2 emissions

5.2 Baseline Energy Model

In addition to the analysis of real-life consumption data, an energy model of the existing building was produced with PHPP software. Comparing the modelled space heating demand with the actual value allows accurate calibration of the model, providing confidence in the results obtained.

This section describes the parameters used in the baseline energy model.

Figure 7: Existing eastern façade

Figure 8: Existing masonry and single-glazed window

5.2.2 Building Fabric

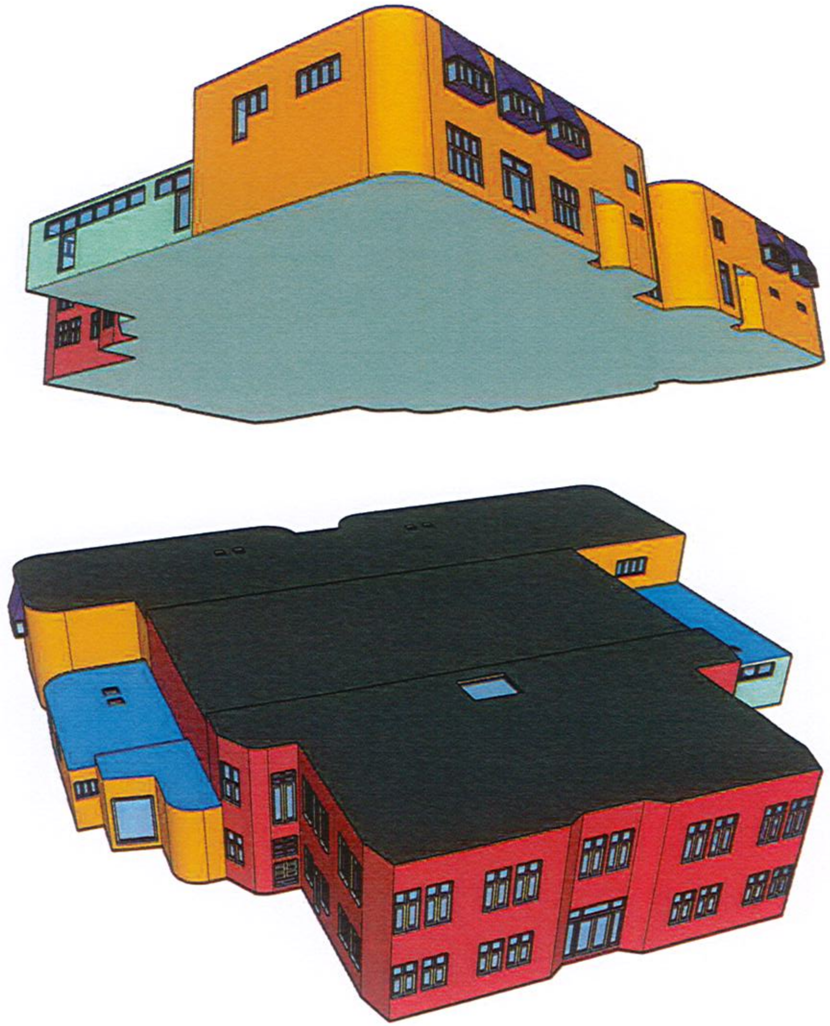


Figure 9: 3D representation of the existing building, colour coded to Table 5

Element	Colour	Description
Existing Walls – Original 1930s		Masonry cavity wall with approximately 70mm of insulation installed in the early 2000s. See right hand image in Figure 2. Insulation type – unknown Assumed insulation thermal conductivity and thickness – 0.07 W/mK, 70mm **U-value = 0.65 W/m²K**
Existing Walls - Other		Masonry cavity wall with approximately 70mm of insulation installed before the early 2000s. See left hand image in Figure 2. Insulation type – cellulose (assumed) Assumed insulation thermal conductivity and thickness – 0.045 W/mK, 70mm **U-value = 0.49 W/m²K**
Existing Walls – 'Portakabin'		Assumed to be lightweight timber structure with timber external finish and no insulation. **U-value = 1.49 W/m²K**
Existing Walls - 'Dormers' (North and West Facades)		Assumed to be lightweight timber structure with timber externa finish and no insulation. **U-value = 1.49 W/m²K**
Existing Roofs – Insulated 2011		Concrete slab with 100mm insulation installed in 2011 and a felt finish. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 100mm **U-value = 0.21 W/m²K (note; significant numbers of penetrations and thermal bridges observed)**
Existing Roofs – Not Insulated		Concrete slab with no insulation and a felt finish. **U-value = 4.05 W/m²K**
Existing Ground Floor		Solid concrete slab with no insulation. **U-value = 2.68 W/m²K** Note that this U-value does not include the helpful insulating effect of the ground adjacent to the floor cassette, which reduces in-situ heat loss compared to other building elements.

Table 5: Existing building fabric specification

5.2.3 Other Parameters

A number of other parameters contribute to the final space heating demand.

Element	Description
Windows – 1930s façade	Double glazing, thermal properties assumed to be: **Ug-value (glazing) – 3.0 W/m²K** **Uf-value (frame) - 3.0 W/m²K** g-value (solar gain) – 0.7 Spacer psi-value – 0.08 W/mK
Windows - Other	Single glazing, properties assumed to be: **Ug-value (glazing) – 5.0 W/m²K** **Uf-value (frame) - 2.0 W/m²K** g-value (solar gain) – 0.85
Airtightness	Assumed to be **6.5 ach @ 50Pa**, equivalent to **12.0 m³/m²hr**.
Ventilation	Predominantly natural ventilation with a small amount of localised mechanical extract ventilation.
Thermal Bridging	As current levels of insulation are low, heat loss through thermal bridging will also be low. A small allowance has been made, totalling approximately 2% of overall heat loss from the building.
Heating Source	Heating is provided by 3 x gas boilers located in the plant room. Note that this does not have a direct impact on space heating *demand*, as it only informs how this demand is met.
Shading	Surrounding buildings and trees have been modelled to provide an accurate representation of shading during the heating and cooling seasons.
Internal Temperature	It is assumed that during the heating season a large proportion of the space is not heated. Assuming that offices and communal areas are occupied but others are not, a volume weighted internal temperature of 17.4°C has been calculated.

Table 6: Other parameters used in the baseline PHPP model

5.2.4 Results

The PHPP model of the baseline provides the total space heating demand for verification with the utility bills, as well as a breakdown of where heat is lost. The modelled space heating demand is 105 kWh/m2.year, aligning closely with the real-life value of 108 kWh/m2.year.

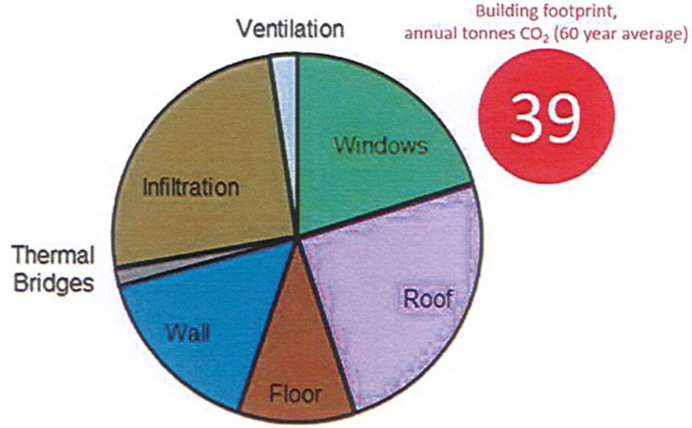
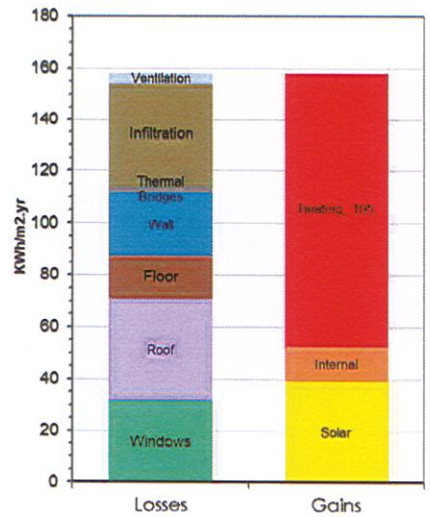


Figure 10: Breakdown of heat losses from existing building, and heat loss balance



6 Proposed Scheme

The proposed refurbishment and extension involves a new 2 storey extension to the East and a new entrance to the North. New windows will be provided to the North, West and East facades. The proposed scheme is shown in Figure 11, and can be compared to colours subsequent sections.

The treated floor area of the proposed scheme increases to 2128 m2.

Indicative build-up drawings of proposed wall treatments are shown in Appendix B, with elevation drawings by Foster Wilson in Appendix C.

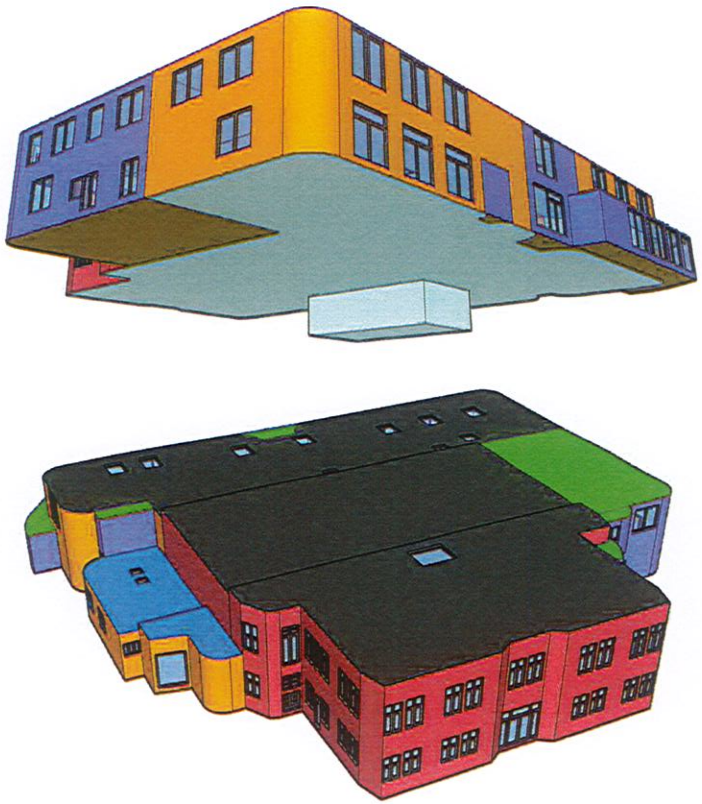


Figure 11: 3D representation of the proposed scheme

7 Option 1 – Energy Model

7.1 Building Fabric

Element	Colour	Description
Existing Walls – Original 1930s		Masonry cavity wall with approximately 70mm of insulation installed in the early 2000s. Insulation type – unknown Assumed insulation thermal conductivity and thickness – 0.07 W/mK, 70mm **U-value = 0.65 W/m²K**
Existing Walls – Other		Masonry cavity wall with approximately 70mm of insulation installed before the early 2000s. Insulation type – cellulose (assumed) Assumed insulation thermal conductivity and thickness – 0.045 W/mK, 70mm **U-value = 0.49 W/m²K**
New Walls		Construction type to be confirmed. Insulation type – mineral wool Assumed insulation thermal conductivity and thickness – 0.040 W/mK, 135mm **U-value = 0.28 W/m²K** (this is the limiting value in Approved Document Part L2B)
Existing Roofs – Insulated 2011		Concrete slab with 100mm insulation installed in 2011 and a felt finish. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 100mm **U-value = 0.21 W/m²K**
Existing Roofs – Not Insulated		Concrete slab with no insulation and a felt finish. **U-value = 4.05 W/m²K**

New Roofs		Construction type to be confirmed. Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 120mm Insulation type – PIR **U-value = 0.18 W/m²K** (this is the limiting value in Approved Document Part L2B)
Existing Ground Floor		Solid concrete slab with no insulation. **U-value = 2.68 W/m²K**
New Ground Floors		Solid concrete with insulation below slab. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 90mm **U-value = 0.23 W/m²K** (this is the limiting value in Approved Document Part L2B)

Table 7: Option 1 building fabric specification

7.2 Other Parameters

A number of other parameters contribute to the final space heating demand.

Element	Description
Windows – 1930s façade	Double glazing, thermal properties assumed to be: **Ug-value (glazing) – 3.0 W/m²K** **Uf-value (frame) - 3.0 W/m²K** g-value (solar gain) – 0.7 Spacer psi-value – 0.08 W/mK
Windows - Other	Single glazing replaced with modern double glazing: **Ug-value (glazing) – 1.2 W/m²K** **Uf-value (frame) – 2.0 W/m²K** g-value (solar gain) – 0.7 Spacer psi-value – 0.04 W/mK
Airtightness	Assumed to be **5.0 ach @ 50Pa**, equivalent to **9.6 m³/m²hr**. This improvement could be achieved through installation of new windows and a dedicated air barrier to new building elements.
Ventilation	Mechanical ventilation with heat recovery to some areas, with natural ventilation to others.
Thermal Bridging	As levels of insulation are low, heat loss through thermal bridging will also be low. A small allowance has been made, totalling approximately 3% of overall heat loss from the building.
Heating Source	Heating is provided by 3 x gas boilers located in the plant room. Note that this does not have a direct impact on space heating *demand*, as it only informs how this demand is met.
Shading	Surrounding buildings and trees have been modelled to provide an accurate representation of shading during the heating and cooling seasons.
Internal Temperature	It is assumed that during the heating season a large proportion of the space is not heated. A slightly increased internal temperature of 18.0°C has been used to represent improved comfort levels.

Table 8: Other Option 1 PHPP parameters

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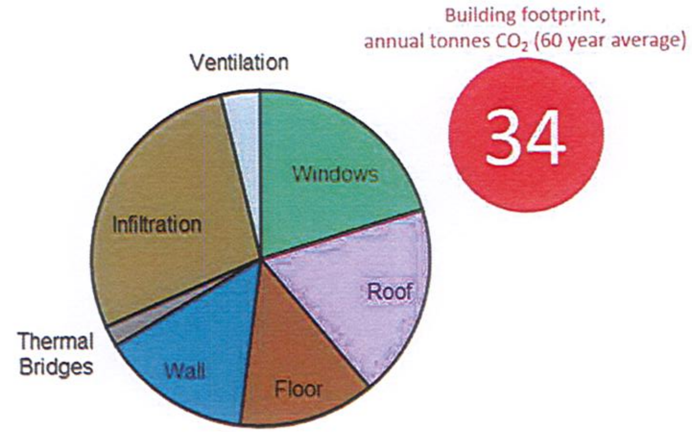
7.3 Results

The PHPP model of Option 1 provides the total space heating demand of the proposal, as well as a breakdown of where heat is lost. The modelled space heating demand is 66 kWh/m².year, a 37% reduction over the current building.



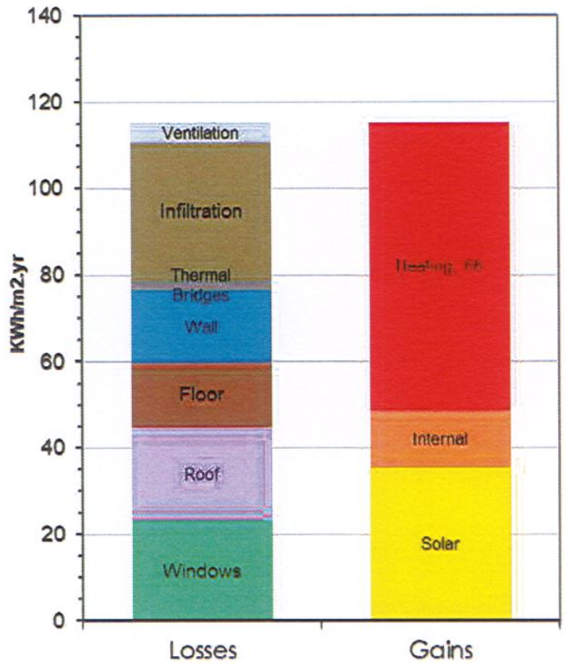


Figure 12: Breakdown of heat losses from existing building, heat loss balance, and CO2 emissions

8 Option 2 – Energy Model

8.1 Building Fabric

Element	Colour	Description
Existing Walls – Original 1930s		Masonry cavity wall with approximately 70mm of insulation installed in the early 2000s, plus 40mm of new internal wall insulation. Insulation type – unknown, plus new woodfibre Assumed insulation thermal conductivity and thickness – 0.07 W/mK, 70mm, **plus 0.04 W/mK, 40mm** **U-value = 0.40 W/m^{2}K**
Existing Walls – Other		Masonry cavity wall with approximately 70mm of insulation installed before the early 2000s, plus 40mm of new internal wall insulation. Insulation type – cellulose (assumed), plus new woodfibre Assumed insulation thermal conductivity and thickness – 0.045 W/mK, 70mm, **plus 0.04 W/mK, 40mm** **U-value = 0.33 W/m^{2}K**
New Walls		Construction type to be confirmed. Insulation type – mineral wool Assumed insulation thermal conductivity and thickness – 0.040 W/mK, 150mm **U-value = 0.26 W/m^{2}K**
Existing Roofs – Insulated 2011		Concrete slab with 100mm insulation installed in 2011 and a felt finish. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 100mm **U-value = 0.21 W/m^{2}K**
Existing Roofs – Not Insulated		Concrete slab with no insulation and a felt finish. **U-value = 4.05 W/m^{2}K**

New Roofs		Construction type to be confirmed. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 150mm **U-value = 0.14 W/m²K**
Existing Ground Floor		Solid concrete slab with no insulation. **U-value = 2.68 W/m²K**
New Ground Floors		Solid concrete with insulation below slab. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 120mm **U-value = 0.18 W/m²K**

Table 9: Option 2 building fabric specification

8.2 Other Parameters

A number of other parameters contribute to the final space heating demand.

Element	Description
Windows – 1930s façade	Existing double glazing replaced with modern double glazing: **Ug-value (glazing) – 1.2 W/m²K** **Uf-value (frame) - 2.0 W/m²K** g-value (solar gain) – 0.7 Spacer psi-value – 0.04 W/mK
Windows - Other	Single glazing replaced with modern double glazing: **Ug-value (glazing) – 1.2 W/m²K** **Uf-value (frame) – 2.0 W/m²K** g-value (solar gain) – 0.7 Spacer psi-value – 0.04 W/mK
Airtightness	Assumed to be **3.0 ach @ 50Pa**, equivalent to **5.8 m³/m²hr**. This improvement could be achieved through installation of new windows, a dedicated air barrier to new building elements and installation of new internal wall insulation.
Ventilation	Mechanical ventilation with heat recovery to some areas, with natural ventilation to others.
Thermal Bridging	As levels of insulation are still low, heat loss through thermal bridging will also be relatively low. An allowance has been made, totalling approximately 5% of overall heat loss from the building.
Heating Source	Heating is provided by 3 x gas boilers located in the plant room. Note that this does not have a direct impact on space heating *demand*, as it only informs how this demand is met.
Shading	Surrounding buildings and trees have been modelled to provide an accurate representation of shading during the heating and cooling seasons.
Internal Temperature	It is assumed that during the heating season a large proportion of the space is not heated. A slightly increased internal temperature of 18.5°C has been used to represent improved comfort levels.

Table 10: Other Option 2 PHPP parameters

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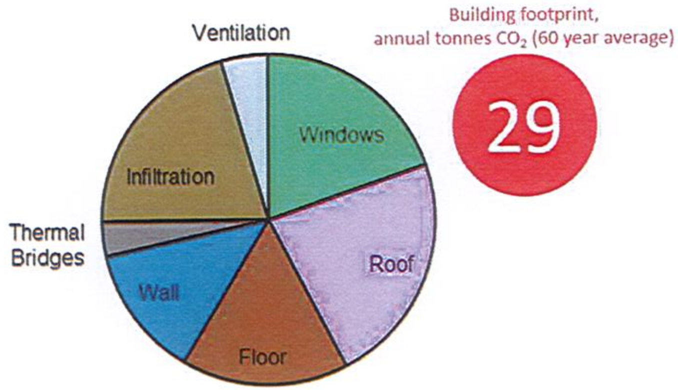
8.3 Results

The PHPP model of Option 2 provides the total space heating demand of the proposal, as well as a breakdown of where heat is lost. The modelled space heating demand is 54 kWh/m^2.year, a 49% reduction over the current building.



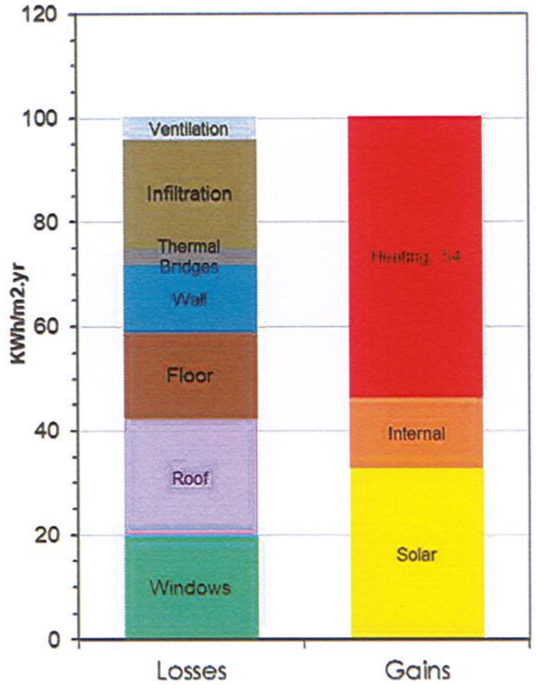


Figure 13: Breakdown of heat losses from existing building, heat loss balance, and CO_2 emissions

9 Option 3 – Energy Model

9.1 Building Fabric

Element	Colour	Description
Existing Walls – Original 1930s		Masonry cavity wall with approximately 70mm of insulation installed in the early 2000s, plus 40mm of new internal wall insulation. Insulation type – unknown, plus new woodfibre Assumed insulation thermal conductivity and thickness – 0.07 W/mK, 70mm, **plus 0.04 W/mK, 40mm** **U-value = 0.40 W/m²K**
Existing Walls – Other		Masonry cavity wall with approximately 70mm of insulation installed before the early 2000s, plus 100mm of new external wall insulation. Insulation type – cellulose (assumed), plus new EPS external wall insulation Assumed insulation thermal conductivity and thickness – 0.045 W/mK, 70mm, **plus 0.035 W/mK, 100mm** **U-value = 0.21 W/m²K**
New Walls		Construction type to be confirmed. Insulation type – mineral wool Assumed insulation thermal conductivity and thickness – 0.040 W/mK, 200mm **U-value = 0.19 W/m²K**
Existing Roofs – Insulated 2011		Concrete slab with 100mm insulation installed in 2011 and a felt finish, plus 100mm of additional insulation Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 100mm, **plus new 100mm** **U-value = 0.11 W/m²K**
Existing Roofs – Other		Concrete slab with 200mm new insulation as above **U-value = 0.11 W/m²K**

New Roofs		Construction type to be confirmed. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 200mm **U-value = 0.11 W/m²K**
Existing Ground Floor		Solid concrete slab with no insulation. **U-value = 2.68 W/m²K**
New Ground Floors		Solid concrete with insulation below slab. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 120mm **U-value = 0.18 W/m²K**

Table 11: Option 3 building fabric specification

9.2 Other Parameters

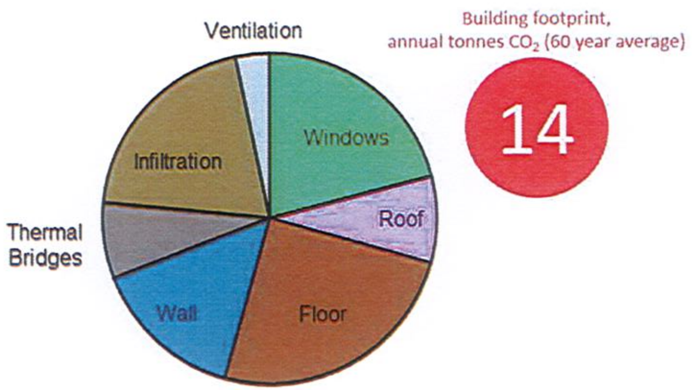
A number of other parameters contribute to the final space heating demand.

Element	Description
Windows – 1930s façade	Existing double glazing replaced with modern triple glazing, of the Crittal type if required for conservation: **Ug-value (glazing) – 1.0 W/m²K** **Uf-value (frame) - 1.5 W/m²K** g-value (solar gain) – 0.6 Spacer psi-value – 0.04 W/mK
Windows - Other	Single glazing replaced with modern triple glazing: **Ug-value (glazing) – 0.6 W/m²K** **Uf-value (frame) – 1.0 W/m²K** g-value (solar gain) – 0.5 Spacer psi-value – 0.04 W/mK
Airtightness	Assumed to be **2.0 ach @ 50Pa**, equivalent to **3.8 m³/m²hr**. This improvement could be achieved through installation of new windows, a dedicated air barrier to new building elements, installation of new wall insulation, and use of proprietary tapes and membranes where appropriate. Robust design and interim testing would also be required.
Ventilation	Mechanical ventilation with heat recovery throughout, with overall heat recovery efficiency of 87%
Thermal Bridging	As levels of insulation increase, so will heat loss through thermal bridging, particularly when using internal wall insulation. An allowance has been made, totalling approximately 12% of overall heat loss from the building.
Heating Source	It is now assumed that gas boilers will be incrementally replaced with air source heat pumps, with the demand split evenly between the two systems. This is for illustrative purposes, the exact proportions would depend on the details of the design.
Shading	Surrounding buildings and trees have been modelled to provide an accurate representation of shading during the heating and cooling seasons.
Internal Temperature	Increased levels of insulation will mean maintaining a comfortable temperature throughout the whole building becomes easier, so an industry standard internal temperature of 20°C has been used.

Table 12: Other Option 3 PHPP parameters

9.3 Results

The PHPP model of Option 3 provides the total space heating demand of the proposal, as well as a breakdown of where heat is lost. The modelled space heating demand is 39 kWh/m².year, a 63% reduction over the current building.



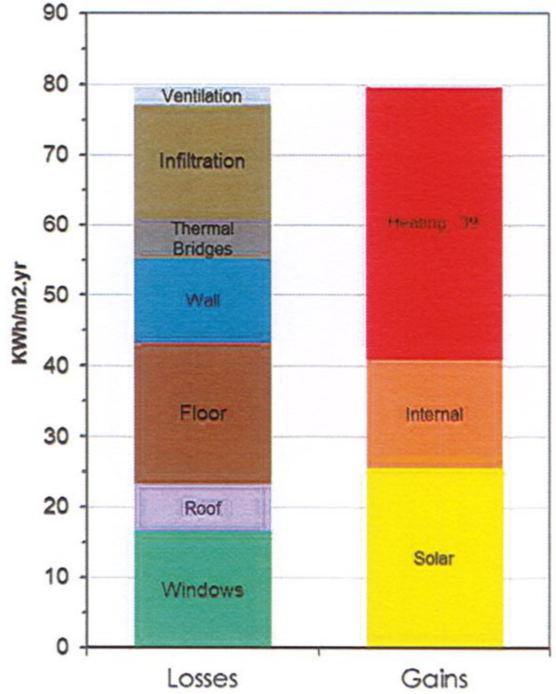


Figure 14: Breakdown of heat losses from existing building, heat loss balance, and CO_2 emissions

10 Option 4 – Energy Model

10.1 Building Fabric

Element	Colour	Description
Existing Walls – Original 1930s		Masonry cavity wall with approximately 70mm of insulation installed in the early 2000s, plus 120mm of new external wall insulation. Insulation type – unknown, plus new EPS external wall insulation Assumed insulation thermal conductivity and thickness – 0.07 W/mK, 70mm, **plus 0.035 W/mK, 120mm** **U-value = 0.20 W/m²K**
Existing Walls – Other		Masonry cavity wall with approximately 70mm of insulation installed before the early 2000s, plus 120mm of new external wall insulation. Insulation type – cellulose (assumed), plus new EPS external wall insulation Assumed insulation thermal conductivity and thickness – 0.045 W/mK, 70mm, **plus 0.035 W/mK, 120mm** **U-value = 0.18 W/m²K**
New Walls		Construction type to be confirmed. Insulation type – mineral wool Assumed insulation thermal conductivity and thickness – 0.040 W/mK, 200mm **U-value = 0.19 W/m²K**
Existing Roofs – Insulated 2011		Concrete slab with 100mm insulation installed in 2011 and a felt finish, plus 100mm of additional insulation Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 100mm, **plus new 100mm** **U-value = 0.11 W/m²K**
Existing Roofs – Other		Concrete slab with 200mm new insulation as above **U-value = 0.11 W/m²K**

New Roofs		Construction type to be confirmed. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 200mm **U-value = 0.11 W/m²K**
Existing Ground Floor		Solid concrete slab with new insulation below slab. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 120mm **U-value = 0.18 W/m²K**
New Ground Floors		Solid concrete with insulation below slab. Insulation type – PIR Assumed insulation thermal conductivity and thickness – 0.022 W/mK, 120mm **U-value = 0.18 W/m²K**

Table 13: Option 4 building fabric specification

10.2 Other Parameters

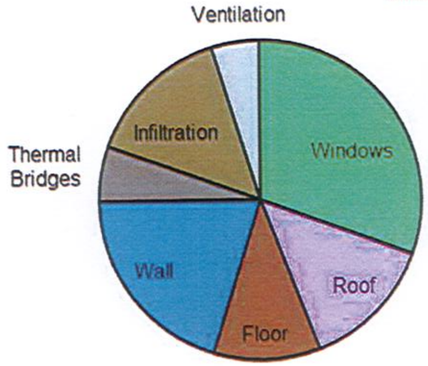
A number of other parameters contribute to the final space heating demand.

Element	Description
Windows – 1930s façade	Existing double glazing replaced with modern triple glazing, of the Crittal type if required for conservation: **Ug-value (glazing) – 1.0 W/m²K** **Uf-value (frame) - 1.5 W/m²K** g-value (solar gain) – 0.6 Spacer psi-value – 0.04 W/mK
Windows - Other	Single glazing replaced with modern triple glazing: **Ug-value (glazing) – 0.6 W/m²K** **Uf-value (frame) – 1.0 W/m²K** g-value (solar gain) – 0.5 Spacer psi-value – 0.04 W/mK
Airtightness	Assumed to be **1.0 ach @ 50Pa**, equivalent to **1.9 m³/m²hr**. This improvement could be achieved through installation of new windows, a dedicated air barrier to new building elements, installation of new wall insulation, and use of proprietary tapes and membranes where appropriate. Robust design and interim testing would also be required.
Ventilation	Mechanical ventilation with heat recovery throughout, with overall heat recovery efficiency of 87%
Thermal Bridging	As levels of insulation increase, so will heat loss through thermal bridging. However, careful detailing of an external wall insulation system will reduce this. An allowance has been made, totalling approximately 7% of overall heat loss from the building.
Heating Source	It is now assumed that gas boilers will be fully replaced with air source heat pumps with an average CoP of 3.0.
Shading	Surrounding buildings and trees have been modelled to provide an accurate representation of shading during the heating and cooling seasons.
Internal Temperature	Increased levels of insulation will mean maintaining a comfortable temperature throughout the whole building becomes easier, so an industry standard internal temperature of 20°C has been used. This is also the temperature used for EnerPHit certification.

Table 14: Other Option 4 PHPP parameters

10.3 Results

The PHPP model of Option 4 provides the total space heating demand of the proposal, as well as a breakdown of where heat is lost. The modelled space heating demand is 20 kWh/m^2.year, an 81% reduction over the current building. This building specification would achieve EnerPHit certification.



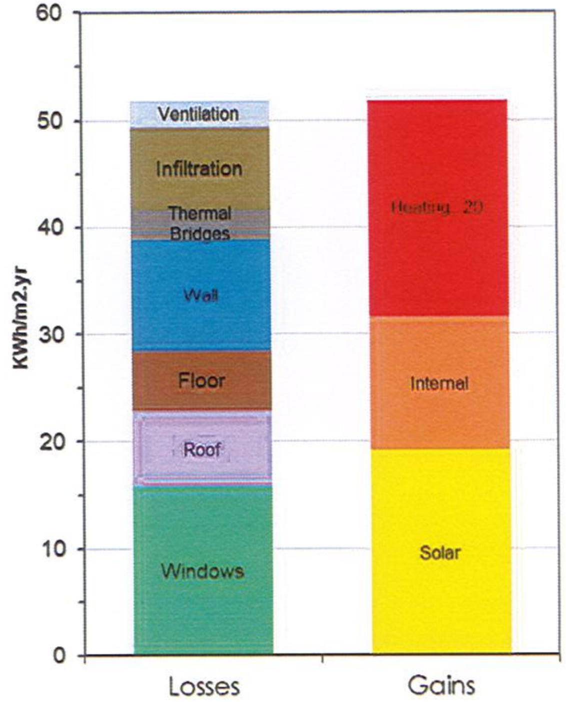


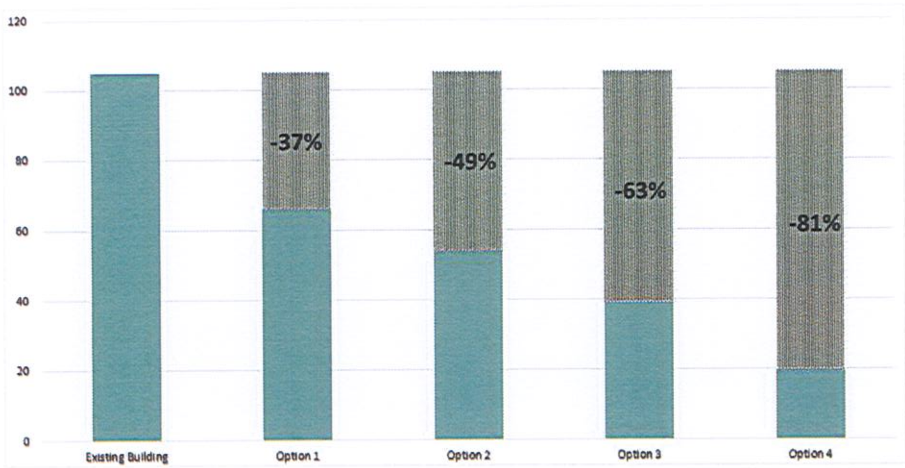
Figure 15: Breakdown of heat losses from existing building, heat loss balance, and CO_2 emissions

11 Summary of Results – Energy

11.1 Space Heating

The space heating demand decreases significantly from options 1 through to 4. This demand is independent of how the energy is supplied.

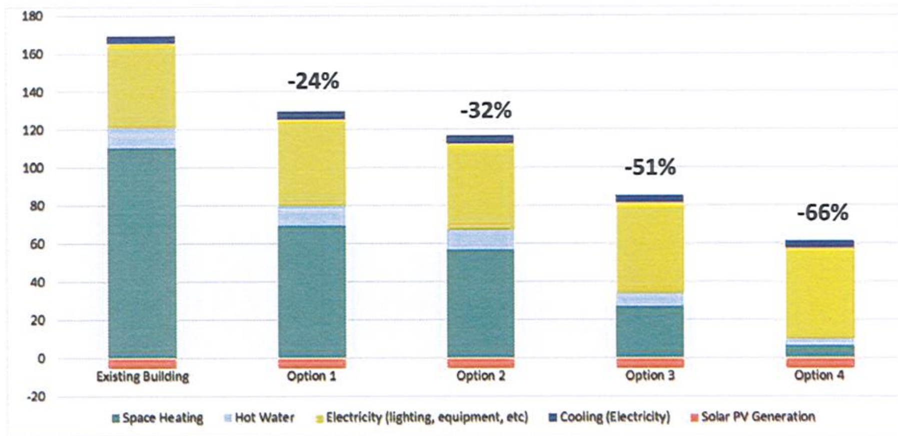
Figure 16: Space Heating Demand (kWh/m².year)



11.2 Total Energy Consumption

Assuming energy demand for hot water and cooling remain constant, significant energy savings are still made. A gas boiler efficiency of 95% has been assumed, with an average heat pump CoP of 3.0 in options 3 (covering 50% of heating and hot water demand) and 4 (covering all heating and hot water demand). An allowance has also been made for slightly increased electricity consumption to account for new mechanical ventilation systems.

Figure 17: Total Energy Consumption (kWh/m².year)



12 Summary of Results – Carbon Emissions

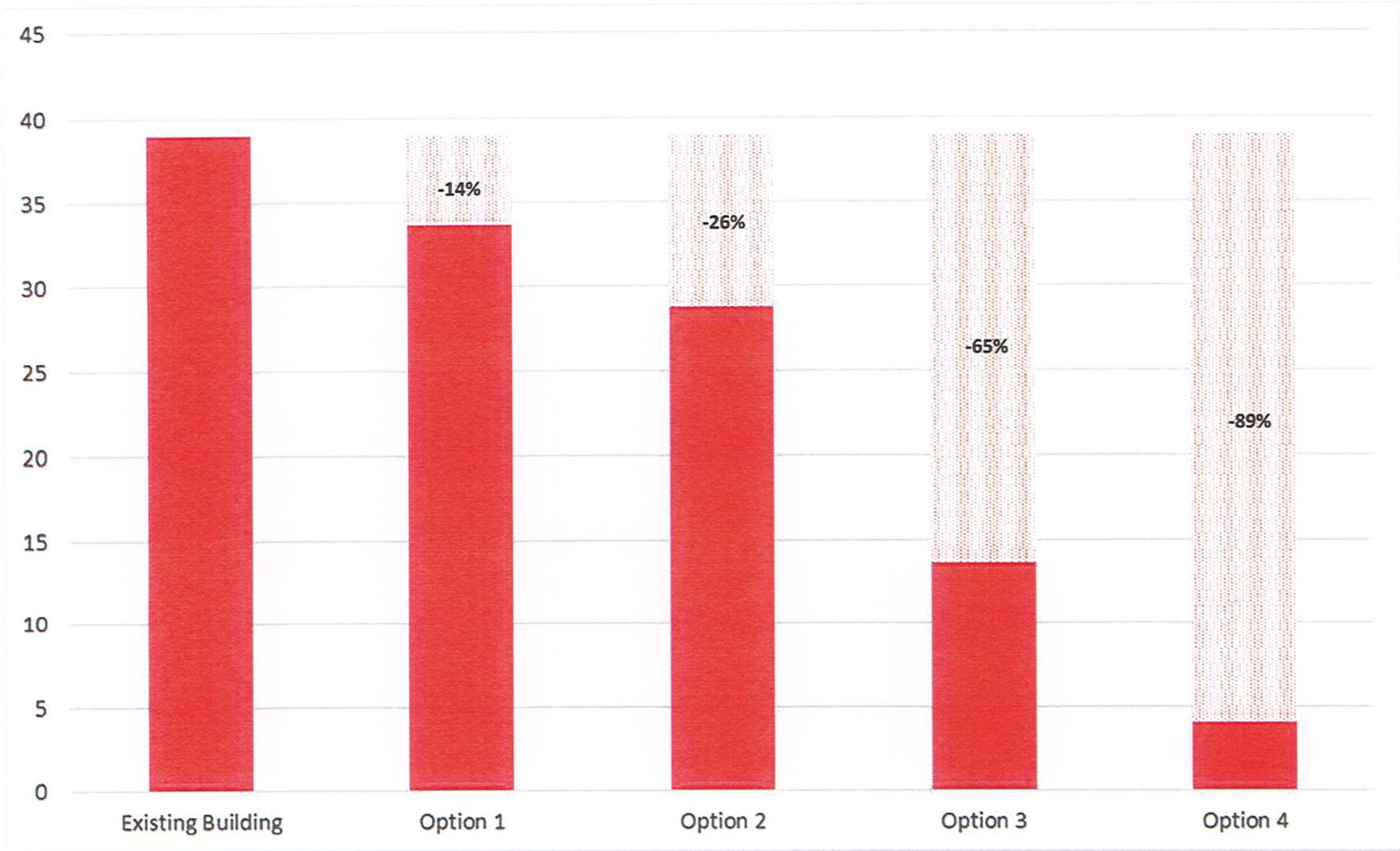
Using the Treasury Green Book it is possible to calculate CO_2 emissions over the next 60 years. Emissions from electricity will vary over time as the National Grid decarbonises, so the results are presented as the 60 year average.

An allowance for electrical energy consumption by new ventilation systems has been made. This is likely to be insignificant in Options 1 and 2, but will be larger in Options 3 and 4. For Options 3 and 4, an allowance of 7,000 kWh/year has been included, equivalent to 0.3 tonnes of CO_2 per year over 60 years.

	Average Annual CO_2 Emissions – Gas for Heating and Hot Water 2021-2080 (tonnes CO_2)	Average Annual CO_2 Emissions – Electricity for Heating and Hot Water 2021-2080 (tonnes CO_2)	Average Annual CO_2 Emissions – Electricity for Lighting, Appliances, Pumps, Fans, etc 2021-2080 (tonnes CO_2)	Average Annual CO_2 Emissions Offset by Existing Solar PV System 2021-2080 (tonnes CO_2)	TOTAL Average Annual CO_2 Emissions 2021-2080 (tonnes CO_2)
Existing Building	36.11	0	3.34	-0.42	**39.0**
Option 1	30.68	0	3.44	-0.42	**33.7**
Option 2	25.74	0	3.44	-0.42	**28.8**
Option 3	9.78	0.74	3.64	-0.42	**13.7**
Option 4	0	0.88	3.64	-0.42	**4.1**

Table 15: Average annual CO_2 emissions

Figure 18: Average CO_2 Emissions Over 60 Years (kWh/m².year)



13 Costs

13.1 Capital Costs

Capital cost estimates have been provided by the project QS, Ainsleys, and are presented below. Full details will be available in their package. The upgrade costs here are shown as an actual total, and then compared against Option 1, which is a minimum Part L Building Regulations compliant base case scenario given the wider extension, refurbishments and plan to replace many windows regardless of energy performance. Capital costs exclude VAT on the basis that this will not be paid or will be reclaimed. Costs could change as more detailed specifications are developed, and further discussion with Ainsleys will be required.

	Actual Capital Cost of Fabric and Ventilation Upgrades (£)	Actual Capital Cost of Air Source Heat Pump Upgrades (£)	TOTAL ACTUAL CAPITAL COST OF UPGRADES (£)	Capital Cost 'Over and Above' Option 1 (£)
Option 1	415,000	0	415,000	**0**
Option 2	565,000	0	565,000	**150,000**
Option 3	1,188,500	33,250	1,221,750	**806,750**
Option 4	1,354,500	55,500	1,410,000	**995,000**

Table 16: Estimated capital costs of energy efficiency upgrades.

13.2 Operational Costs

Using predicted energy prices in the Treasury Green Book Central Forecast, it is possible to estimate running costs over the next 60 years. These have been shown as annual costs for 2021 and 2080, as well as a total cost over 60 years.

In addition to actual fuel bills, emitting CO_2 has an implicit cost. The GLA (Greater London Authority) is currently charging £100/tonne of CO_2 emitted on construction projects. This is expected to rise gradually over time. Although the Petersfield Festival Hall will not be subject to these actual costs, it is fair that they be taken into account when considering energy efficiency upgrades, as carbon emissions have a costly societal impact. For the figures shown here, the cost of CO_2 is assumed to be £100/tonne in 2021, rising by 3% per year until reaching a cap of £500/tonne by 2076. Operational costs include VAT, as it is understood that this is paid by the Council on utility bills.

	Gas Cost 2021 (£/year)	Electricity Cost 2021 (£/year)	Carbon Cost 2021 (£/year)	Gas Cost 2080 (£/year)	Electricity Cost 2080 (£/year)	Carbon Cost 2080 (£/year)	Total Cost 2021 (£/year)	Total Cost 2080 (£/year)
Option 1	4,849	10,884	3,855	6,384	11,360	16,295	**19,588**	**34,039**
Option 2	4,067	10,884	3,361	5,355	11,360	13,875	**18,312**	**30,590**
Option 3	1,545	13,912	2,004	2,034	14,520	6,175	**17,461**	**22,729**
Option 4	0.00	14,377	1,064	0.00	15,005	1,330	**15,441**	**16,335**

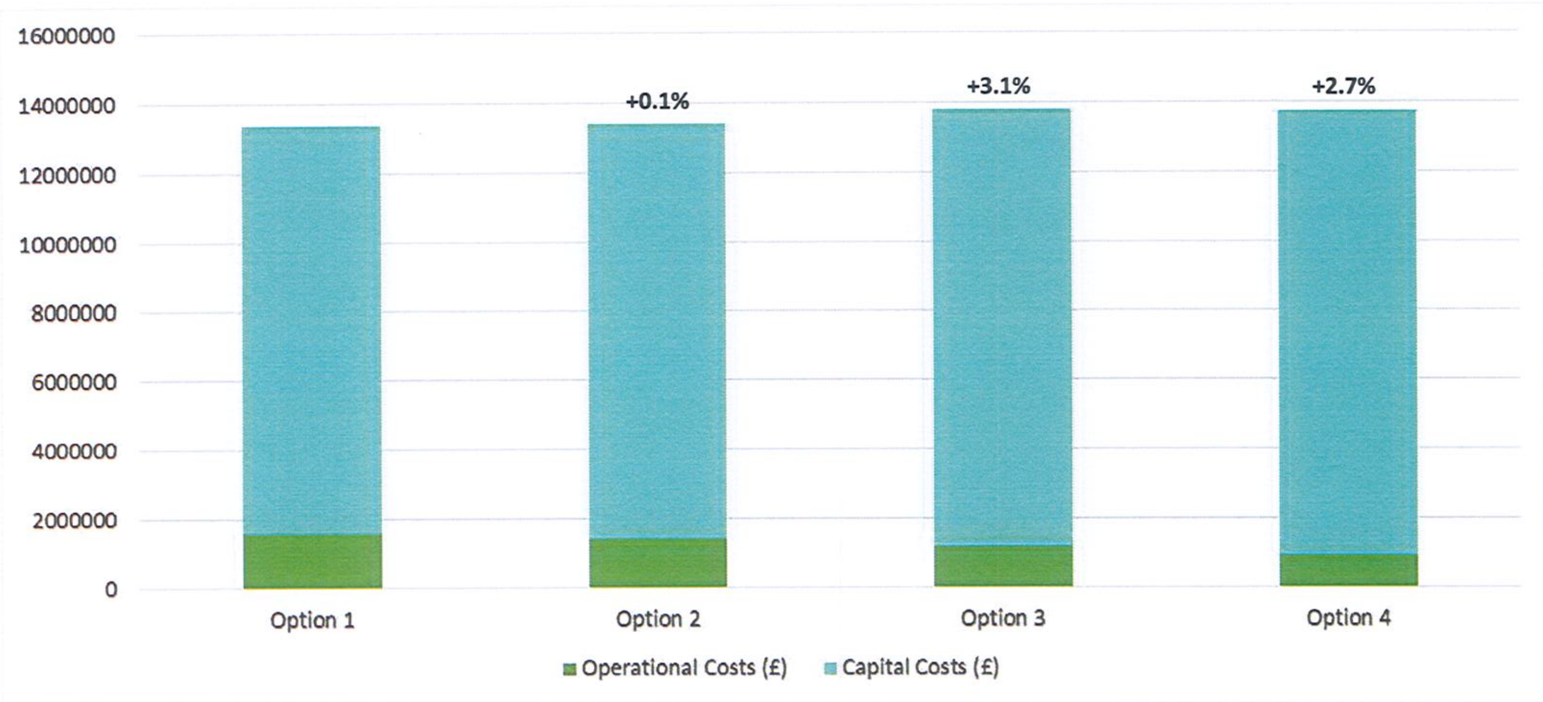
Table 17: Summary of annual operational costs in 2021 and 2080

Comparing total 60 year operational costs to the total capital costs of the scheme provides an estimate of whole-life costs.

	Total Capital Cost of Proposal (ex VAT) (£)	Total Operational Costs Over 60 years (inc VAT) (£)	TOTAL 60 year cost (£)
Option 1	11,781,000	1,600,142	**13,381,142**
Option 2	11,931,000	1,460,479	**13,391,479**
Option 3	12,587,750	1,210,482	**13,798,232**
Option 4	12,776,000	964,829	**13,740,829**

Table 18: Summary of whole life costs

Figure 19: Total 60 Year Costs Compared to Option 1 (£)



14 EnerPHit and Zero-Carbon

As part of their Climate Emergency Strategy, the Petersfield Town Council have committed to all council buildings being zero-carbon by 2035. It is unlikely that the Festival Hall will undergo significant works between now and then, so implementing measures that will allow this to be achieved is important **now**.

If zero-carbon status is not achieved immediately, a plan that will enable this to happen over the coming years should be mapped out.

14.1 EnerPHit

EnerPHit is the Passivhaus Building Standard for renovation of existing buildings. Developed in the 1990s, Passivhaus focuses on a "fabric-first" approach to minimise energy demand through use of insulation, airtightness, triple glazing, heat recovery ventilation, and thermal bridge free design. In addition to reducing energy demand, the EnerPHit Standard produces comfortable and healthy internal environments all year round. The Passivhaus modelling tool, PHPP, has been used throughout this report.

The EnerPHit Standard can be achieved independently of zero-carbon status, and does not place emphasis on how energy is delivered (e.g. whether through gas boilers or air source heat pumps).

However, a truly sustainable solution relies on significant energy demand reduction compared to current levels, so EnerPHit can be regarded as an important steppingstone to zero-carbon. Reliance on decarbonisation of energy supplies alone is not an approach that could be rolled out across the UK's existing building stock without placing unrealistic demands on infrastructure. Consequently, EnerPHit certification, or a similar approach, will be essential in achieving the Council's zero-carbon goal.

This report demonstrates that achieving EnerPHit certification of the Festival Hall is possible, given the specification described in Option 4. If the specification is too demanding, a step-by-step approach over the coming years could also achieve certification, or similar levels of performance. This is discussed in more detail in section 16.

If EnerPHit certification is targeted, important technical considerations would be:

- Confirmation of the approach to insulating existing external walls. Although Option 4 uses external wall insulation (EWI) throughout, a combination of different solutions could also achieve the necessary levels of performance.
- Ensuring that the ventilation design meets EnerPHit requirements, almost certainly using a Passivhaus certified air handling unit.
- Confirmation of the approach to insulating the existing ground floor. Although Option 4 assumes it would be insulated, it is recognised that this would be expensive and invasive. Vertical perimeter insulation would be sufficient instead, particularly if coupled with EWI, and if the performance of other elements are improved slightly.
- Whether there are any heritage/conservation requirements on windows, which could limit thermal performance.
- Development of a comprehensive whole-building airtightness strategy, necessary to achieve the stringent EnerPHit airtightness requirement.

14.2 Zero-Carbon

Alongside EnerPHit, an understanding of the feasibility of achieving zero-carbon should be developed. Zero-carbon is often ill-defined, as measurement can be complicated and confused by offsetting. It is recommended that the LETI (London Energy Transformation Initiative) definition of net-zero operational carbon be used where appropriate.

The Option 4 CO_2 emissions, assuming use of electric heat pumps throughout, are 4.1 tonnes per year. There would be various routes to this level of emissions by 2035, which would then need to be offset by renewable energy generation.

In addition to the existing 9.84 kWp solar PV system, it is estimated that 110 kWp of solar PV would be required to offset the average of 4.1 tonnes CO_2 per year. Solar PV technology evolves rapidly, but around 330 panels (1.6m x 1m) would be required. Approximately 80 of these could be accommodated on the roof space of the existing building, particularly if layout of rooflights and other services is rationalised.

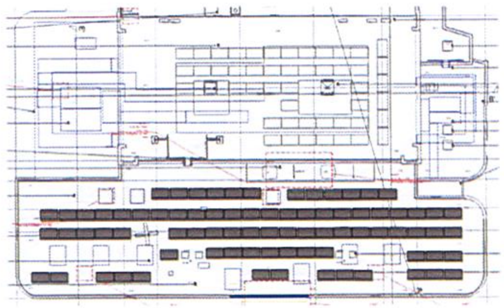


Figure 20: Indicative new solar PV layout (in grey)

The remaining carbon emissions would have to be offset by investment into off-site renewable energy capacity or a renewable energy Power Purchase Agreement (PPA).

It should be noted that the figures presented in Option 4 represent only one scenario, and could change significantly as detailed designs develop. Carbon emissions are strongly dependent on the building fabric performance and efficiency of heat pumps. If either were improved, carbon emissions would reduce significantly.

Measures such as low energy lighting, energy efficient appliances, and occupant behavior could also reduce electricity consumption, which makes up a significant proportion of total energy once space heating demand has been reduced.

If zero-carbon is not achieved during this phase of the project, certain items should be incorporated to make it an easily achievable goal by 2035:

- Avoiding "lock-in" of half-hearted building fabric upgrades. If it is likely that the building will not undergo another fabric refurbishment before 2035, any works undertaken now should be sufficient to enable future achievement of zero-carbon. Options 1 and 2 both incur undesirable lock-in upgrades.

- Heating emitters and infrastructure should be specified and sized appropriately to allow an easy and cost-effective switch to electric heat pumps at the appropriate time.

- Consideration should be given to whether it is more cost effective to install additional renewable energy generation (solar PV) now, while other roof works are being undertaken.

15 Other Considerations

In addition to energy and carbon savings, various other considerations should be included in the decision-making process.

15.1 Conservation and Planning Permission

It is recognised that planning and conservation constraints may be an important factor in deciding on the best approach, particularly regarding external wall insulation and replacement of windows.

A wide variety of finishes are available with external wall insulation, including brick-slips and render. Similarly, high performance triple glazing is available to suit a wide variety of contexts.

15.2 Moisture

Insulating existing walls should be done with caution, as it can have an impact on how moisture interacts with the building envelope.

External wall insulation is generally low-risk, as the insulation keeps the existing building warm and it is therefore less vulnerable to condensation.

Internal wall insulation is higher risk as application of the insulation makes the existing masonry colder than it was previously, and therefore more vulnerable to condensation and moisture damage. Use of mechanical ventilation to remove internal moisture is beneficial.

It was noticed during the site survey that there is some moisture ingress around the curved sections of the 1930s façade, suggesting that there is a pathway for moisture from outside to in. If internal wall insulation is applied to these areas, it is suggested that this pathway should be identified and eliminated as a priority. An overall assessment of the moisture implications of installing internal wall insulation should also be undertaken, taking into account internal and external conditions.

15.3 New-Build

It has been suggested that demolishing the entire existing Festival Hall and replacing it would be a possibility.

This would make achieving high levels of energy performance, and therefore zero-carbon, easier.

However, the embodied carbon associated with new construction materials is huge. This is the carbon "locked-in" to materials during extraction, manufacture, transport and construction, and is particularly significant in concrete and steel.

The carbon embodied in new materials and emitted during construction of a new Festival Hall would be equivalent to more than 30 years of operational carbon emissions of the existing building (or 300 years of the Option 4 operational emisions), so this is not a sensible option when considering carbon emissions in the round.

The existing single-storey western extension has a complex form which would be difficult to insulate. Demolition of this small area and replacement with a new extension could therefore be considered, particularly if the new extension also presented the opportunity for architectural and functional improvements.

16 Recommendations and Next Steps

This report has demonstrated that the extension and refurbishment of the Petersfield Festival Hall presents an opportunity to greatly reduce energy consumption and CO_2 emissions.

The options presented are not exhaustive, it is possible that the best solution will be a combination of measures from different options.

Planning and budgetary constraints will also be a factor, but the pros and cons of each option are shown in Table 19.

It is clear that Options 1 and 2 do not include sufficient building fabric performance upgrades to make zero carbon an achievable goal by 2035 without major future upgrades. If the Council wishes to achieve this goal without undertaking other major works before 2035, they should therefore not be pursued.

If financial and planning constraints are overcome, an approach similar to Option 4, including EnerPHit certification, would be the best way to achieve large energy savings and zero carbon, and is the recommendation of the authors.

If project constraints mean that this is not feasible, elements of Option 3 could be incorporated while still achieving significant energy savings, and zero carbon before 2035.

Although the capital costs of options 3 and 4 are relatively large, the quality of the final product will be superior to options 1 or 2. The EnerPHit Standard encourages high quality construction, and the internal environment will be comfortable all year round, in addition to the huge carbon savings.

It should be recognised that the building fabric performance of options 3 and 4 provides greater flexibility on potential upgrade of heating and hot water systems. Achieving zero-carbon is reliant on electrification of these systems with heat pumps. However, as the existing gas boilers are relatively new and working well, a phased and gradual approach to their replacement would be reasonable.

In order to enable progression into a planning application and RIBA Stage 4 design, the following steps should be taken:

- Expected planning and budgetary constraints should be defined. This may depend on success of a possible application to the SALIX fund.
- Following this, building fabric upgrades can be decided upon by the Council and their advisors. It is suggested that working back from Option 4 measures to match the budget would be a good approach.
- Once building fabric performance is well-defined, Skelly & Couch can design mechanical systems accordingly, providing a straightforward upgrade path to heat pumps as a minimum. Although air source heat pumps have been assumed throughout this report, ground source heat pumps could be an alternative possibility with a better coefficient of performance (CoP).

Although all values presented in this report are as accurate as possible, they will change as the architectural and building services designs are developed.

	PROS	CONS
Option 1	• Existing façades largely retained • Reduced requirement for new ventilation plant • 14% CO_2 emission reduction over 60 years	• High levels of energy efficiency not achieved • Zero-carbon not achievable without significant additional work before 2035
Option 2	• Existing façades largely retained • Reduced requirement for new ventilation plant • 26% CO_2 emission reduction over 60 years	• High levels of energy efficiency not achieved • Zero-carbon not achievable without significant additional work before 2035 • Internal wall insulation detailing and moisture management can be difficult
Option 3	• Existing 1930s façade largely retained • 65% CO_2 emission reduction over 60 years • High levels of energy efficiency are achieved • Zero-carbon *could* be achievable by 2035 with an appropriate upgrade path	• Internal wall insulation detailing and moisture management can be difficult • New ventilation plant will be spatially demanding • Appropriate space for air source heat pump(s) required
Option 4	• 89% CO_2 emission reduction over 60 years • Zero-carbon would be achievable with suitable renewables • EnerPHit certification achieved	• External treatment to all existing walls, including 1930s façade • New ventilation plant will be spatially demanding • Appropriate space for air source heat pump(s) required • Invasive and high-cost ground floor insulation required (see comments in section 14.1)

Table 19: Summary of Pros and Cons

17 Appendix A

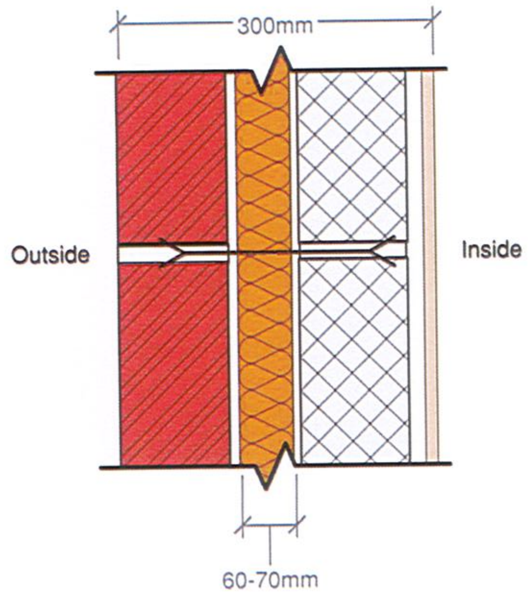
Summary of 2017 and 2018 energy consumption

Month	Heating (Gas, kWh)	Hot Water (Gas, kWh)	Cooling (Electricity, kWh)	Appliances, Lighting, Plug-Loads etc (Electricity, kWh)
January	32,500	1,500	0	7,500
February	29,500	1,500	0	7,500
March	23,500	1,500	0	6,500
April	8,500	1,500	0	6,000
May	6,500	1,500	0	5,500
June	1,500	1,500	2,000	3,000
July	0	1,500	3,000	2,500
August	1,500	1,500	2,000	5,000
September	2,500	1,500	0	6,500
October	10,500	1,500	0	6,000
November	23,500	1,500	0	7,000
December	28,500	1,500	0	6,500
TOTAL (kWh)	**168,500**	**18,000**	**7,000**	**69,500**
TOTAL (kWh/m^2)	**108**	**11**	**4**	**44**

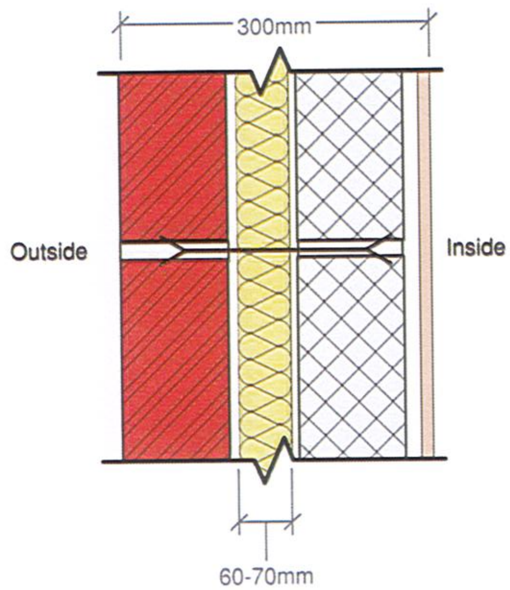
18 Appendix B

Indicative drawings of proposed wall build-ups.

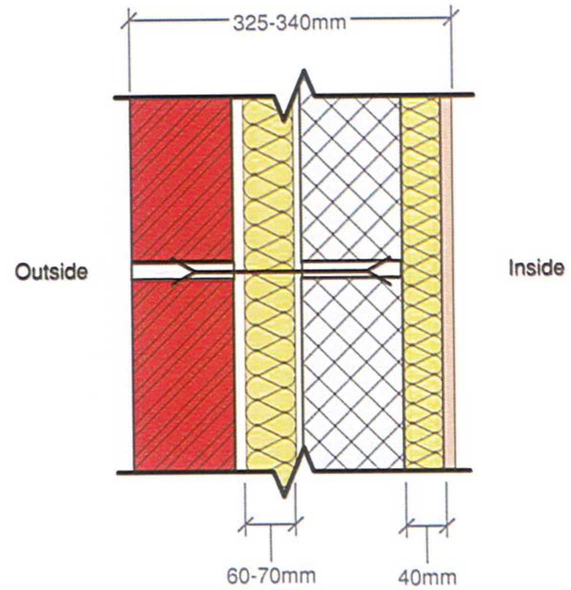
Existing Walls – 1930s façade



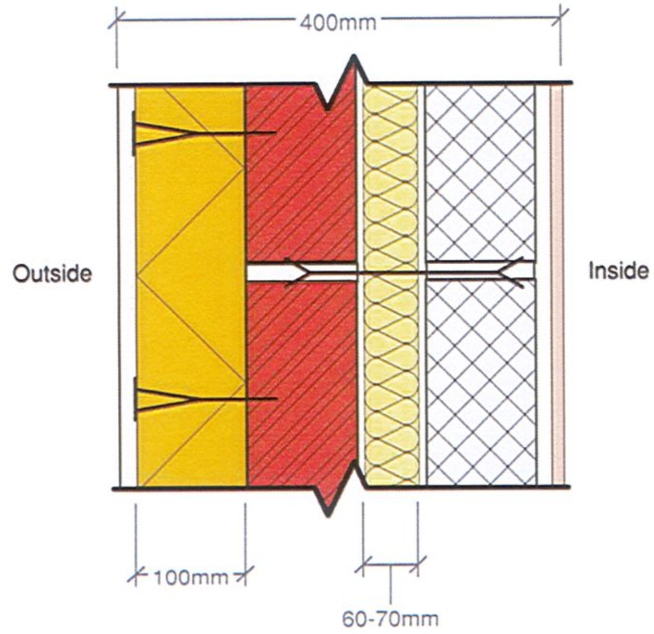
Existing Walls – Other Masonry



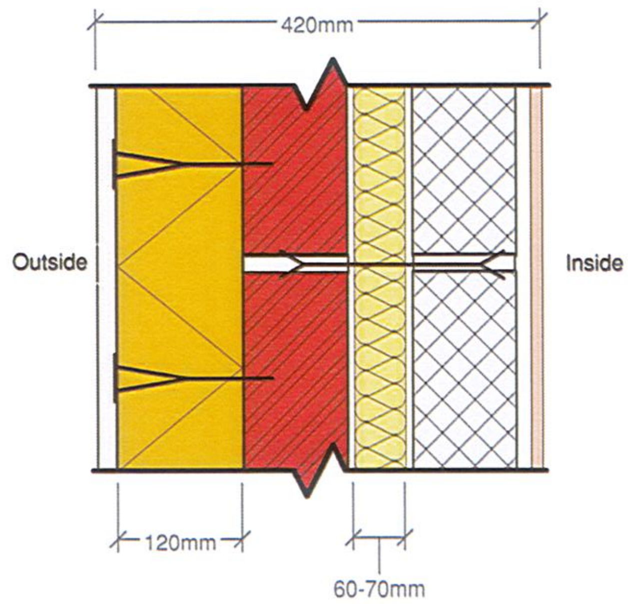
Upgraded Walls – Internal Wall Insulation



Upgraded Walls with 100mm External Wall Insulation



Upgraded Walls with 120mm External Wall Insulation

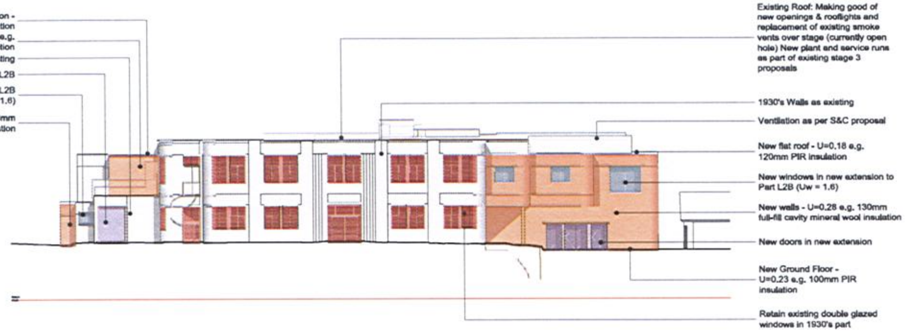


19 Appendix C

Elevation drawings showing approach to insulation

DRAWINGS BY FOSTER WILSON ARCHITECTS

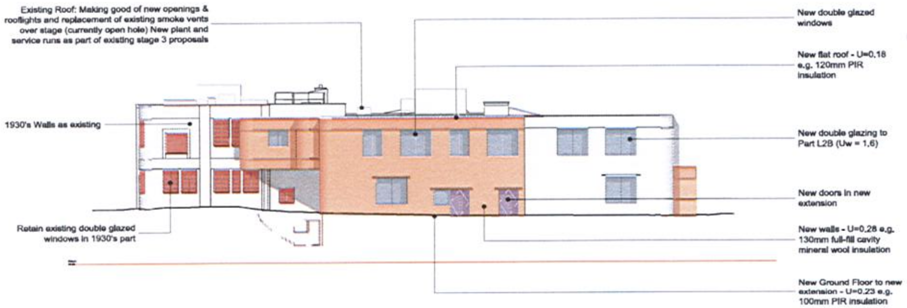
1 NORTH ELEVATION
1:200@A1



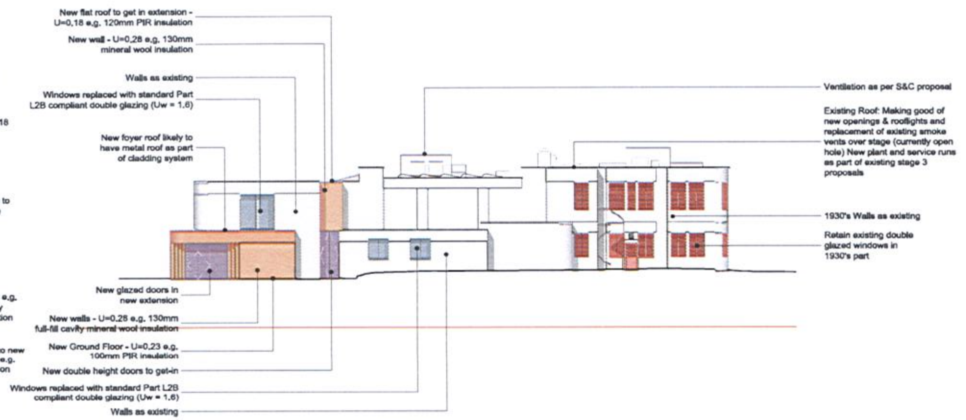
3 SOUTH ELEVATION
1:200@A1

Key

- Existing Double Glazed windows and doors
- New Extension
- New Glazing
- New Doors
- Brick infill in former window openings

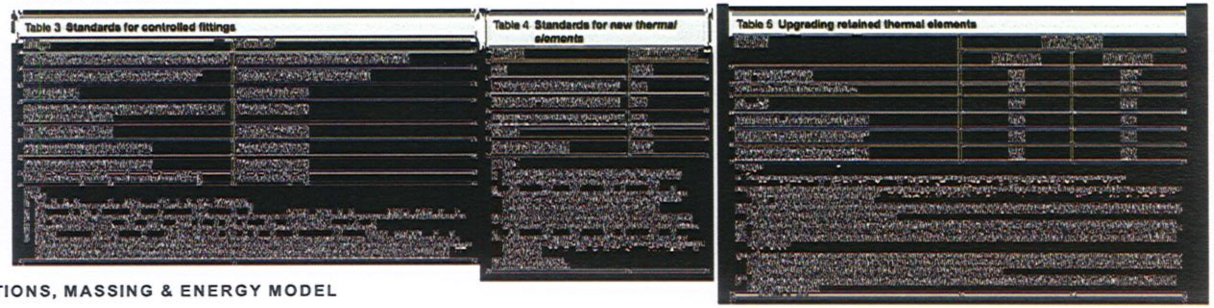


2 EAST ELEVATION
1:200@A1



4 WEST ELEVATION
1:200@A1

Part L2b Extracts



QODA OPTION 1

Option 1 (78 kWh/m2.yr)

Replacement of single glazed windows
Basic draft proofing, replace leakiest elements (e.g entrance doors)
New elements to Part L2B

7 air changes per hour

*ELEVATIONS ARE INDICATIVE ONLY - FOR WINDOW LOCATIONS, MASSING & ENERGY MODEL

S0 INITIAL STATUS

as marked

Foster Wilson Architects

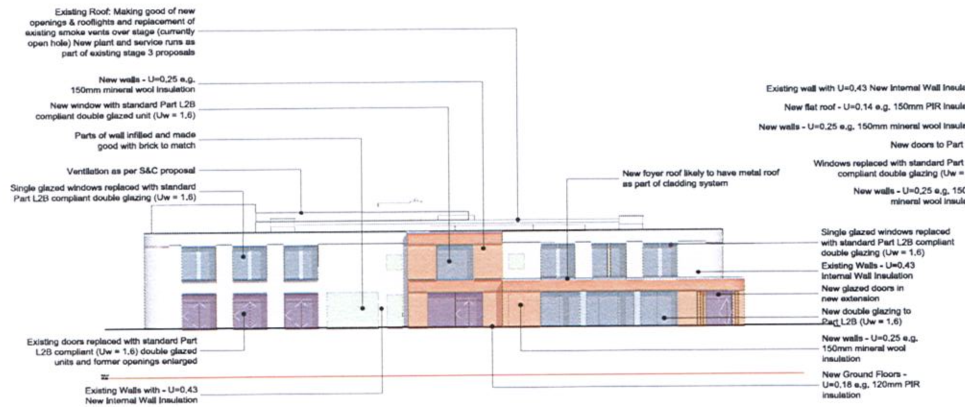
PETERSFIELD FESTIVAL HALL

HEATH RD PETERSFIELD GU31 4EA

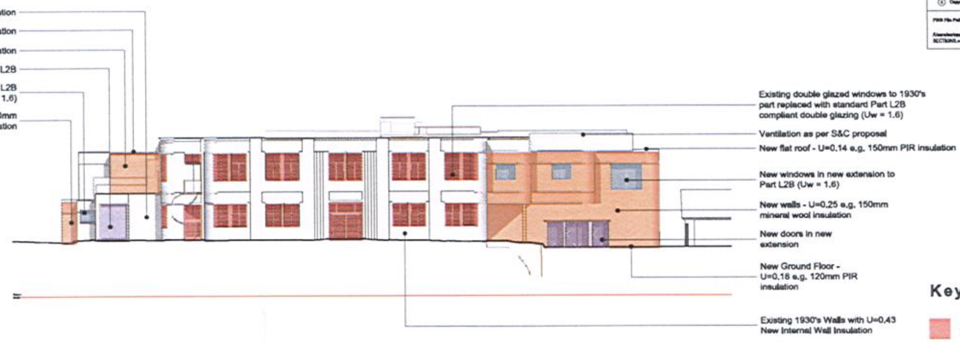
ELEVATIONS ENERGY MARKUP OPTION 1

RIBA STAGE 3 | 2021

590 FWS-XX-ZZ-DR-A 0220.1 | P1.1



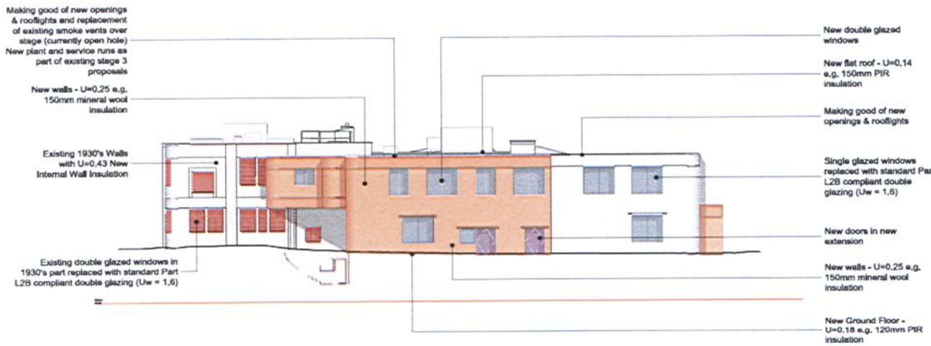
1 NORTH ELEVATION
1:200@A1



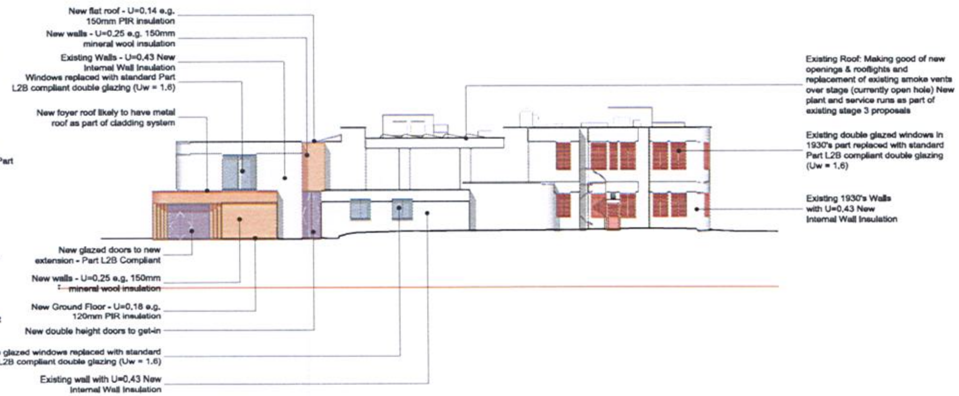
3 SOUTH ELEVATION
1:200@A1

Key

- Existing Double Glazed windows and doors
- New Extension
- New Glazing
- New Doors
- Brick infill in former window openings



2 EAST ELEVATION
1:200@A1



4 WEST ELEVATION
1:200@A1

QODA OPTION 2

Option 2 (59 kWh/m2.yr)

Internal wall insulation
Replacement of windows and double glazing
Mechanical ventilation with heat recovery (e.g. to office spaces)
New elements improved

5 air changes per hour

Part L2b Extracts

Table 3 Standards for controlled fittings

[illegible]	[illegible]

Table 4 Standards for new thermal elements

[illegible]	[illegible]

Table 6 Upgrading retained thermal elements

[illegible]	[illegible]	[illegible]

*ELEVATIONS ARE INDICATIVE ONLY - FOR WINDOW LOCATIONS, MASSING & ENERGY MODEL

S0 INITIAL STATUS

Rev	Date	Drawn/Review	Revision Notes
P1	[illegible]	[illegible]	Stage 3 Energy Options
P1.1	[illegible]	[illegible]	Scale bar revised

Sheet Scale: as marked

Foster Wilson Architects

Project Title: PETERSFIELD FESTIVAL HALL

Project Address: HEATH RD PETERSFIELD GU31 4EA

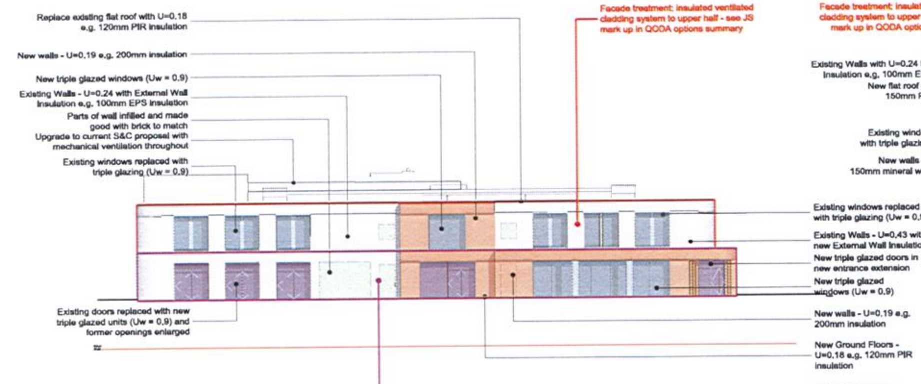
Drawing Title: ELEVATIONS ENERGY MARKUP OPTION 2

Project stage: RIBA STAGE 3

Year: 2021

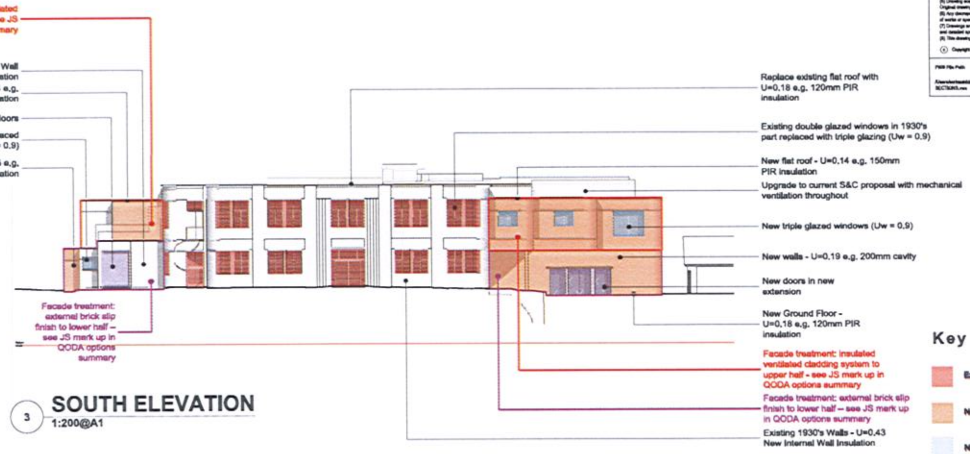
Drawing No.: 590 FWS-XX-ZZ-DR-A 0220.2

Revision: P1.1



NORTH ELEVATION

1 1:200@A1

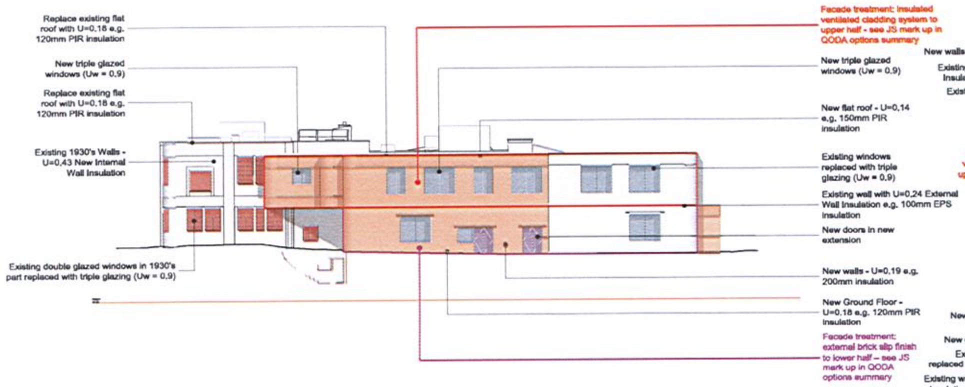


SOUTH ELEVATION

3 1:200@A1

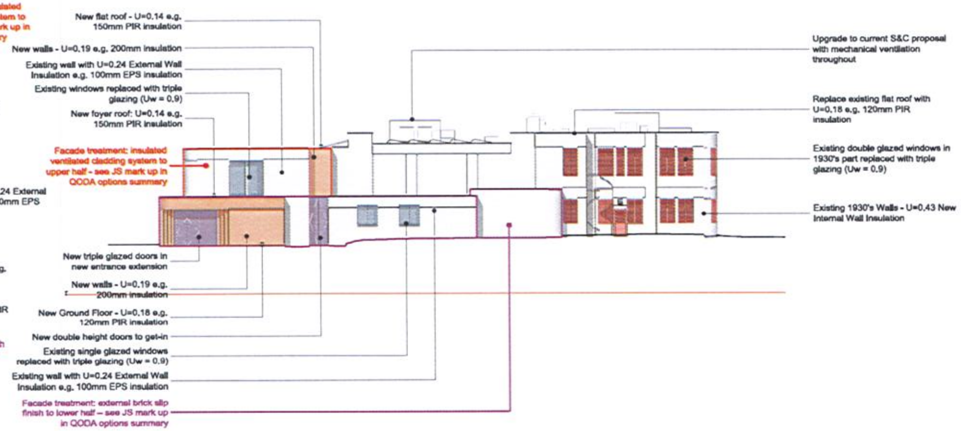
Key

	Existing Double Glazed windows and doors
	New Extension
	New Glazing
	New Doors
	Brick infill in former window openings
	Insulated Cladding System
	External Brick Slip



EAST ELEVATION

2 1:200@A1



WEST ELEVATION

4 1:200@A1

QODA OPTION 3

Option 3 (39 kWh/m2.yr) – around 35 W/m2

Whole building external wall insulation system apart from 1930's part
Replacement of windows with triple glazing
Significant air tightness improvement, including use and propriety products (tapes etc)
Mechanical ventilation with heat recovery (87%)
New insulation to existing flat roofs

3 air changes per hour

*ELEVATIONS ARE INDICATIVE ONLY - FOR WINDOW LOCATIONS, MASSING & ENERGY MODEL

S0 INITIAL STATUS

as marked

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ELEVATIONS ENERGY MARKUP OPTION 3

RIBA STAGE 3 | 2021

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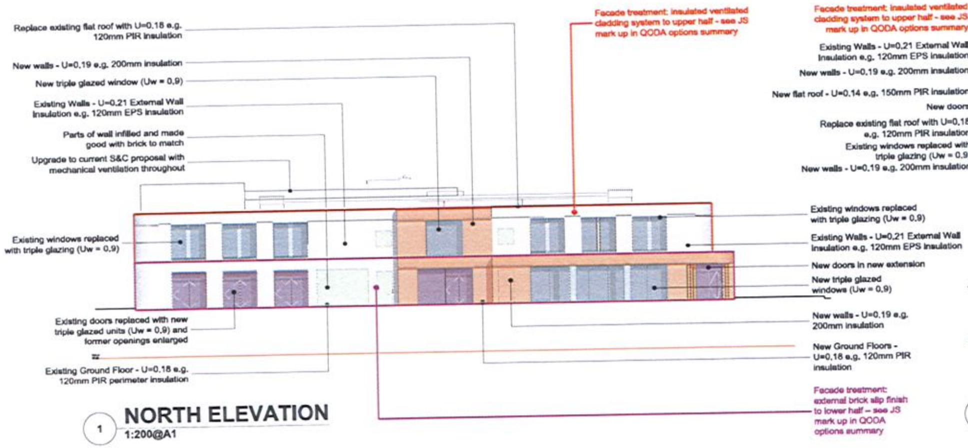
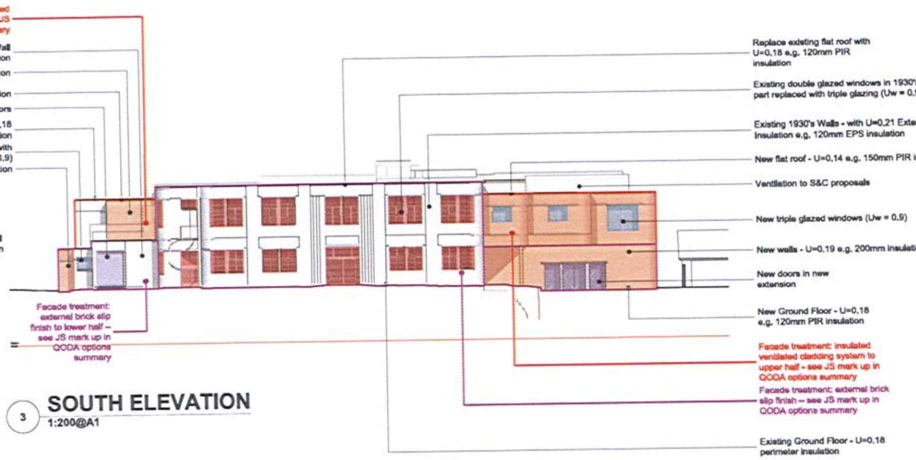
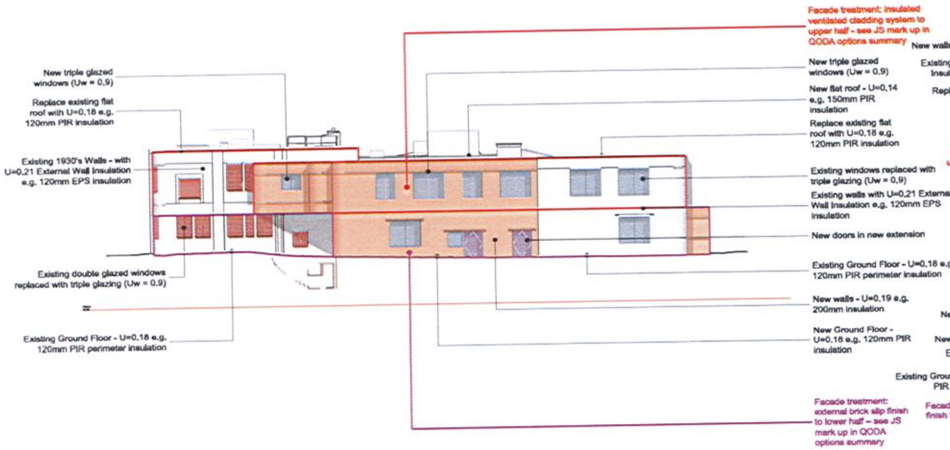


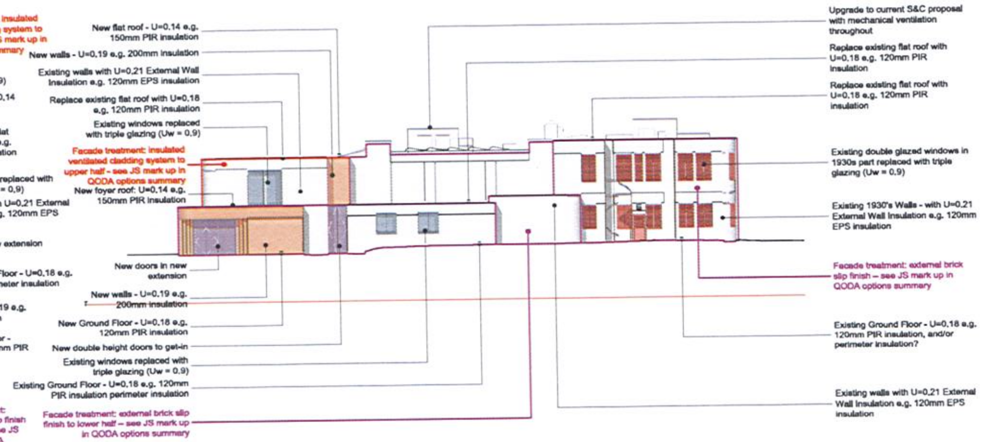
1 NORTH ELEVATION
1:200@A1



3 SOUTH ELEVATION
1:200@A1



2 EAST ELEVATION
1:200@A1



4 WEST ELEVATION
1:200@A1

QODA OPTION 4

Option 4 – EnerPhit (<20 kWh/m2.yr) around 20 W/m2

1 air change per hour

*ELEVATIONS ARE INDICATIVE ONLY - FOR WINDOW LOCATIONS, MASSING & ENERGY MODEL

Key

- Existing Double Glazed windows and doors
- New Extension
- New Glazing
- New Doors
- Brick infill in former window openings
- Insulated Cladding System
- External Brick Slip

S0 INITIAL STATUS

No.	Date	Drawn/Review	Revision Notes
P1	25/02/2021	SS/JS	Stage 3 Energy Options
P1.1	30/02/2021	SS/JS	Scale bar revised

Scale: as marked

Foster Wilson Architects

PETERSFIELD FESTIVAL HALL

HEATH RD PETERSFIELD GU31 4EA

ELEVATIONS ENERGY MARKUP OPTION 4

RIBA STAGE 3 | 2021

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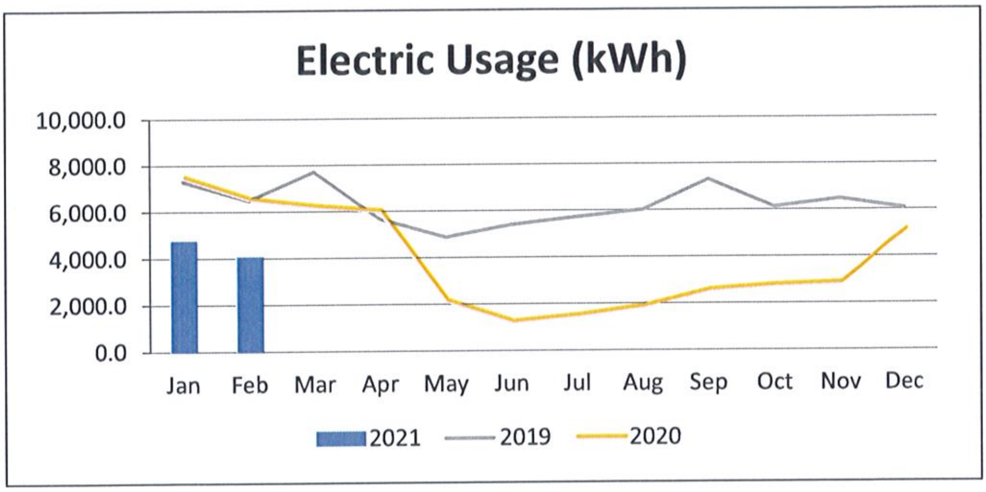
11

Petersfield Town Council

Auditel Monthly Utility Report – February 2021 (COVID 19 LOCKDOWN 3 PERIOD)

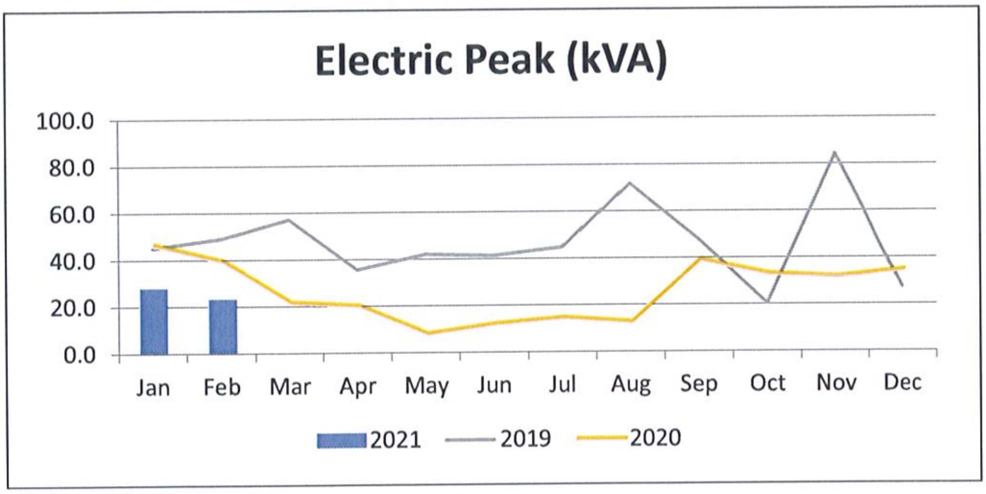
Site: Town Hall

This report is intended to give a short summary of the utility usage at the Town Hall site. Further details or additional information can be obtained from Neil Woolmer.



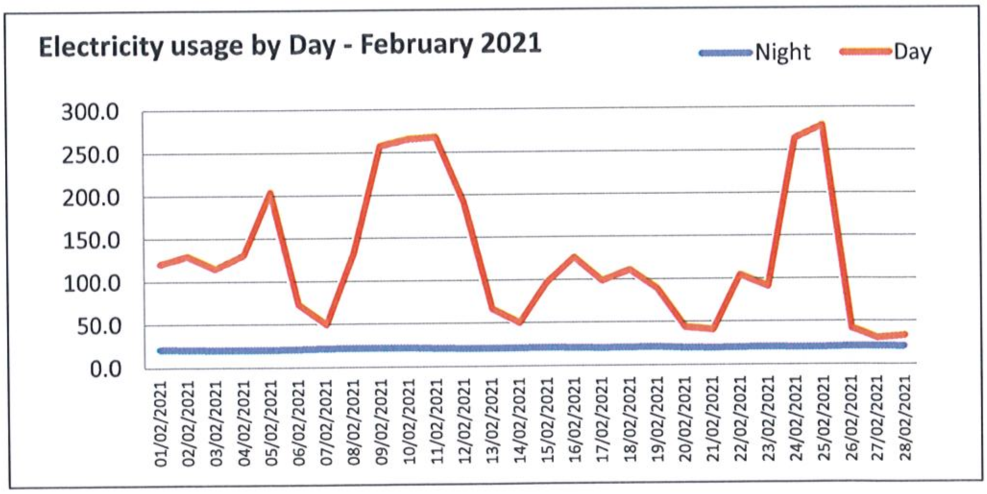
Usage was down 38% against February 2020.

At the end of March 2020 the government brought in measures to combat the spread of COVID-19.

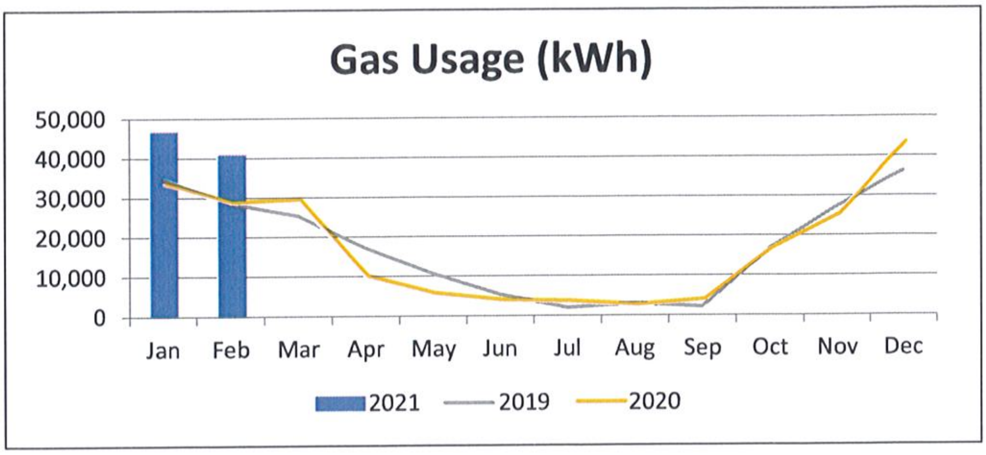


100 kVA Available Capacity

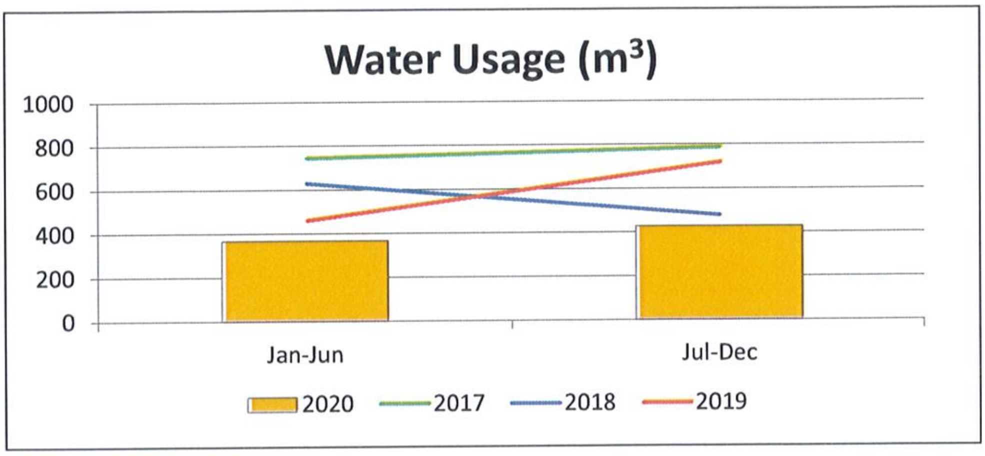
Peak demand was 23.1 kVA in February of the 100 kVA capacity available. Down 41% on the previous year.



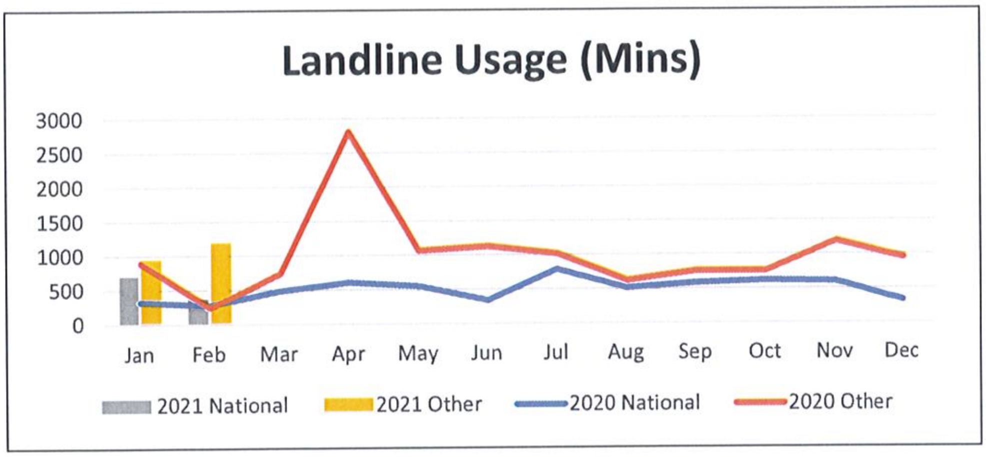
Day and Night kWh usages for February.



Gas usage was up 42% against February 2020.

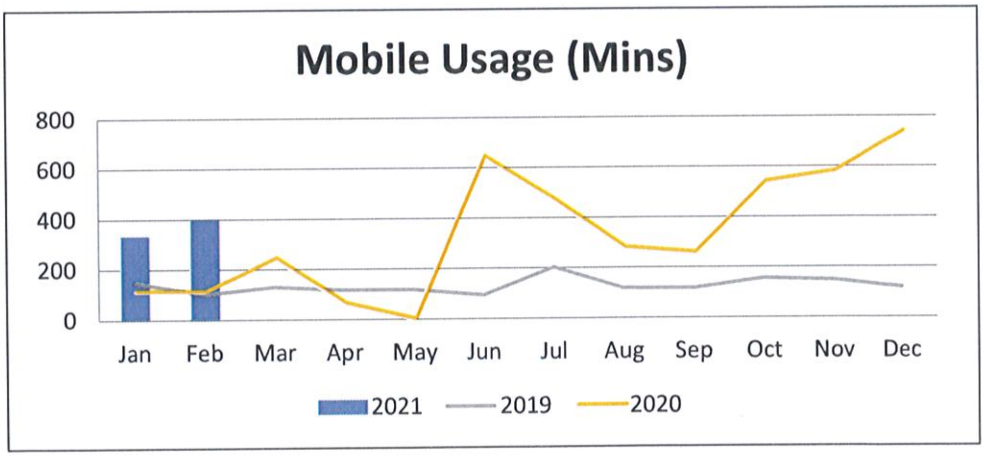


Water usage was down during 2020, April to August's usage dropped 20% and the billed expected usage through to end of February 2021 is down 41%.



National calls were up 34%. Other call types, i.e, to mobiles were up 400%.

Note: due to lack of recording for Local calls we've adjusted the chart to measure National and Other calls 2020/2020 by adding Local and Other calls together for those months where necessary for 2020 & 2020.



Mobile usage was up 259% in February 2020. No additional call charges were incurred. There were 399 minutes of calls recorded.