

CASE STUDY

A 19th century historic property



Edinburgh has numerous fine sandstone dwellings built in Georgian, Victorian and Edwardian periods.

Many are listed buildings, so improvements to bring their thermal performance in line with government targets must be carefully carried out and will require Listed Building Consent.

Holyrood Park Lodge

Used as a visitor centre by Historic Environment Scotland, the Lodge is of traditional construction with external ashlar masonry and internal linings of lath and plaster. The traditional timber single-glazed windows were built in the 1990s.

The works

Using 'best practice' conservation guidance, interventions were chosen on the basis of what the building could withstand, rather than to achieve a specific U Value (the insulation standard). External wall insulation is inappropriate for listed buildings with exterior masonry as it will affect the appearance of the building. Retrofits of modern buildings require airtightness to reduce heat loss, but in older properties this can be detrimental. This thermal upgrade focused on internal changes that also supported ventilation, vital to avoid condensation. The upgrade included:

- Removing 1980s alterations;
- Reinstatement of lost fireplaces and other features;
- Redecorating to original colours, using breathable clay paint;
- Adding internal insulation with natural, vapour-permeable materials, blown into the cavity behind lath and plaster, allowing original plaster to be retained;
- Upgrading windows with slim double-glazing;
- Adjusting ventilation routes;
- Insulating external doors between existing beading with aerogel blanket and ply lining;
- Insulating ground floor between joists, with improved air flow below;

- Inserting sloping roof insulation between rafters from above, leaving lath and plaster in place;
- Adding two types of insulation to attics, to test 'warm' and 'cold' roof solutions;
- Using fireplaces to improve passive ventilation, to prevent condensation;
- Retaining relatively modern condensing boiler, with supplementary electric heating in two difficult locations.

Pre-intervention assessment

1. SAP rating of 35 (Band F)

Recommended work to the Lodge:

- Floor insulation;
- Coomb ceiling and roof insulation;
- Suspended timber floor insulation.

Post intervention monitoring and assessment

1. SAP rating of 71 (Band C)

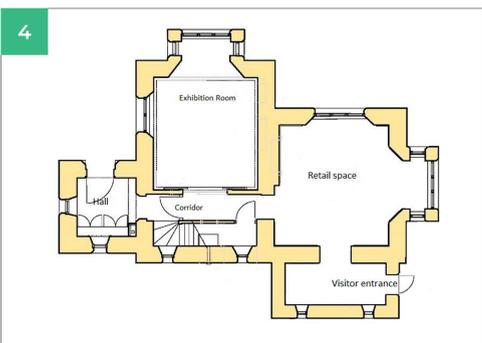
With further work and the addition of renewables, a rating of 82 (Band B) could be achieved:

- Moveable infrared heaters;
- Install damper in reinstated hearth;
- Zoned heating controls;
- Solar thermal hot water;
- Thicker insulation in the coombs;
- Solar PV panels;
- Air leakage - reduced by 26% to 11.25 m³/h/m²;
- Wall insulation – U value at west wall reduced from 1.07 W/m²K to 0.65 W/m²K (36%);
- Relative humidity levels through wall – stabilised with much lower humidity levels.

As a pilot project, Holyrood Lodge showed that traditionally constructed listed buildings can be thermally upgraded in a sensitive and proportionate way, but it is unrealistic to expect performance to be equal to that of a new building, or one that is easier to refurbish. Traditional approaches to ventilation have been successful, and the building is warm and comfortable. Monitoring has shown that careful intervention does not increase hygrothermal risk. The dominant factor in EPC rating for a domestic property is the fuel type, which could not be changed in this trial project.

Future challenges for listed and traditional homes

- Band B requirement (EESH) due to be brought in by the Scottish Government in 2032 where viable;
- Building must be in good condition prior to upgrade;
- Each building is unique and will have a different solution – accredited consultants will be required;
- Poor SAP ratings given by standard assessment methods.
- Development of new assessment software using only measures suitable for existing buildings;
- Higher cost of 'enhanced' SAP assessment for traditional construction;
- Decarbonising heating systems.
- Integrating renewables to listed buildings where appropriate;
- Regular maintenance required to prevent heat loss through damp areas etc.



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EXTERNAL PRE-REFURBISHMENT					
Date	Time	External Air T	Internal Air T	Wind Speed	Conditions
24 th January	8.20 – 9.05 am	9 °C	18 °C	2.0 m/s	Dry
EXTERNAL POST-REFURBISHMENT					
Date	Time	External Air T	Internal Air T	Wind Speed	Conditions
7 th February	8.45 – 9.25 am	4 °C	15 -20 °C	1.0 m/s	Dry

Pre-refurbishment

West Elevation

Post-refurbishment

West Elevation

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Energy Performance Certificate (EPC) Scotland

Dwelling: 2 HORSE WYND, EDINBURGH, EH8 8AZ

Dwelling type: Detached house
 Date of assessment: 11 March 2021
 Date of certificate: 11 March 2021
 Total floor area: 98 m²
 Primary Energy Indicator: 221 kWh/m²/year

Reference number: 9768-1055-9237-6128-1224
 Type of assessment: RUCAP, existing dwelling
 Approved Organisation: Ecolux
 Main heating and fuel: Boiler and radiators, mains gas

You can use this document to:

- Compare current ratings of properties to see which are more energy efficient and environmentally friendly
- Find out how to save energy and money and also reduce CO₂ emissions by improving your home

Estimated energy costs for your home for 3 years* £2,478

Over 3 years you could save* £284

Energy Efficiency Rating

Very energy efficient - lower running costs

Very environmentally friendly - lower CO₂ emissions

Not energy efficient - higher running costs

Not environmentally friendly - higher CO₂ emissions

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years
1 Room-in-roof insulation	£1,500 - £2,700	£84.00
2 Heating controls (time control)	£300 - £400	£138.00
3 Solar water heating	£4,000 - £6,000	£34.00

A full list of recommended improvement measures for your home, together with more information on potential cost and savings and advice to help you carry out improvements can be found in your recommendations report.

To find out more about the recommended measures and how actions you could take today to save energy and money, visit www.gov.uk/government/organisations/historic-scotland or contact Historic Environment Scotland on 0131 552 2242.

THIS PAGE IS THE ENERGY PERFORMANCE CERTIFICATE WHICH MUST BE APPLIED TO THE DWELLING AND NOT BE REMOVED UNLESS IT IS REPLACED WITH AN UPDATED CERTIFICATE.

- Wood-fibre insulation in the south gable space; a 'warm roof'. Note the insulation continuing down in the coomb.
- Wood-fibre insulation batts laid flat between the ceiling joists to give a 'cold roof'.
- Ledged and braced door at the Lodge, before redecoration, showing the plywood panel on top of the aerogel board.
- Ground floor plan of the Lodge as proposed.
- Thermal imaging of 'leaky' doors and windows before and after.
- Energy performance certificate Band C.

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