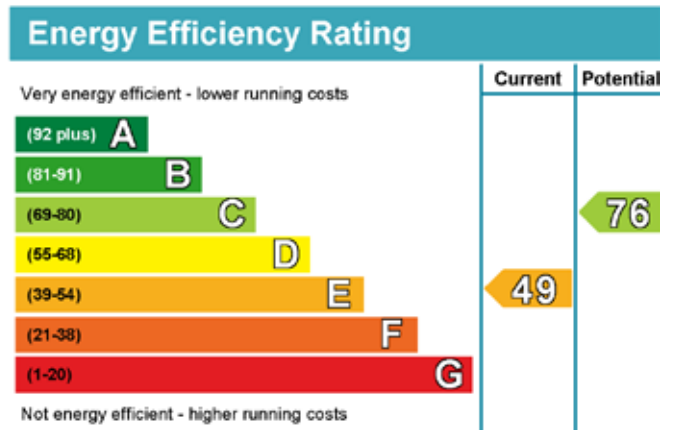




Historic England

Energy Efficiency and Historic Buildings

Energy Performance Certificates



Top actions you can take to save money

Recommended measures



Summary

This guidance is aimed at homeowners and those managing or renting historic or older domestic buildings who may need to commission an Energy Performance Certificate (EPC) or who have received one for an older property that has been purchased or rented.

Details are provided on the type of information included in an EPC, how it is calculated, and its limitations as an assessment method when applied to older buildings. The guidance also covers the issues to be taken into account when commissioning an EPC and considering its recommendations.

Almost every older building can accommodate some energy improvements without harming either its special interest or environmental performance. However, an appropriate balance needs to be achieved between building conservation and measures to improve energy efficiency if lasting damage is to be avoided both to a building's character and significance and its fabric.

This guidance note has been prepared by David Pickles and Caroline Cattini.

It is one of two publications on Energy Performance Certificates. The other guidance note, *Energy Efficiency and Historic Buildings: Advice for Domestic Energy Assessors and Green Deal Advisors*, focuses on the production of EPCs and Green Deal assessments for older buildings.

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www.HistoricEngland.org.uk/advice/technical-advice/energy-efficiency-and-historic-buildings/

Front cover:

1. Listed buildings are exempted from requiring an EPC.
2. Extract from an EPC.
© DCLG
3. Keeping an older building in good repair can help to improve its energy performance.
4. On site tests such as U-value measurements of walls can help in understanding their thermal performance.

Contents

| | | | |
|-----|---|-----|--|
| 1 | When is an EPC Required?.....1 | 5 | Considering Recommended Measures.12 |
| 2 | EPCs and Older Buildings2 | | |
| 2.1 | Commissioning an EPC2 | 5.1 | Compatibility.....12 |
| 2.2 | What's different about older buildings?.....2 | 5.2 | Conservation13 |
| 3 | What Detailed Information Does an EPC Provide?4 | 5.3 | Obtaining consent for the works13 |
| 3.1 | Estimated energy costs and use4 | 5.4 | Cost.....13 |
| 3.2 | Recommendations.....6 | 6 | Where to Get Advice.....14 |
| 3.3 | What is the Green Deal?.....9 | 6.1 | Historic England guidance14 |
| 4 | How is the EPC Calculated?10 | 6.2 | Research Reports14 |
| | | 6.3 | Other publications.....14 |
| | | 6.4 | Contact Historic England15 |

Energy Performance Certificate (EPC)



17 Any Street, District, Any Town, B5 5XX

Dwelling type: Detached house
Date of assessment: 15 August 2011
Date of certificate: 13 March 2012

Reference number: 0919-9628-8430-2785-5996
Type of assessment: RdSAP, existing dwelling
Total floor area: 165 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

| | |
|---|---------------|
| Estimated energy costs of dwelling for 3 years | £5,367 |
| Over 3 years you could save | £2,865 |

Estimated energy costs of this home

| | Current costs | Potential costs | Potential future savings |
|----------------|---------------------|---------------------|--------------------------|
| Lighting | £375 over 3 years | £207 over 3 years | |
| Heating | £4,443 over 3 years | £2,073 over 3 years | |
| Hot water | £549 over 3 years | £222 over 3 years | |
| Totals: | £5,367 | £2,502 | |

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating

| | Current | Potential | |
|---|-----------|-----------|---|
| Very energy efficient - lower running costs | | | |
| (92 plus) A | | | |
| (81-91) B | | | |
| (69-80) C | | 76 | <p>The graph shows the current energy efficiency of your home.</p> <p>The higher the rating the lower your fuel bills are likely to be.</p> <p>The potential rating shows the effect of undertaking the recommendations on page 3.</p> <p>The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).</p> |
| (55-68) D | 49 | | |
| (39-54) E | | | |
| (21-38) F | | | |
| (1-20) G | | | |
| Not energy efficient - higher running costs | | | |

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

| Recommended measures | Indicative cost | Typical savings over 3 years | Available with Green Deal |
|--------------------------------------|-----------------|------------------------------|---------------------------|
| 1 Increase loft insulation to 270 mm | £100 - £350 | £141 | ✓ |
| 2 Cavity wall insulation | £500 - £1,500 | £537 | ✓ |
| 3 Draught proofing | £80 - £120 | £78 | ✓ |

See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit www.direct.gov.uk/savingenergy or call 0300 123 1234 (standard national rate). When the Green Deal launches, it may allow you to make your home warmer and cheaper to run at no up-front cost.

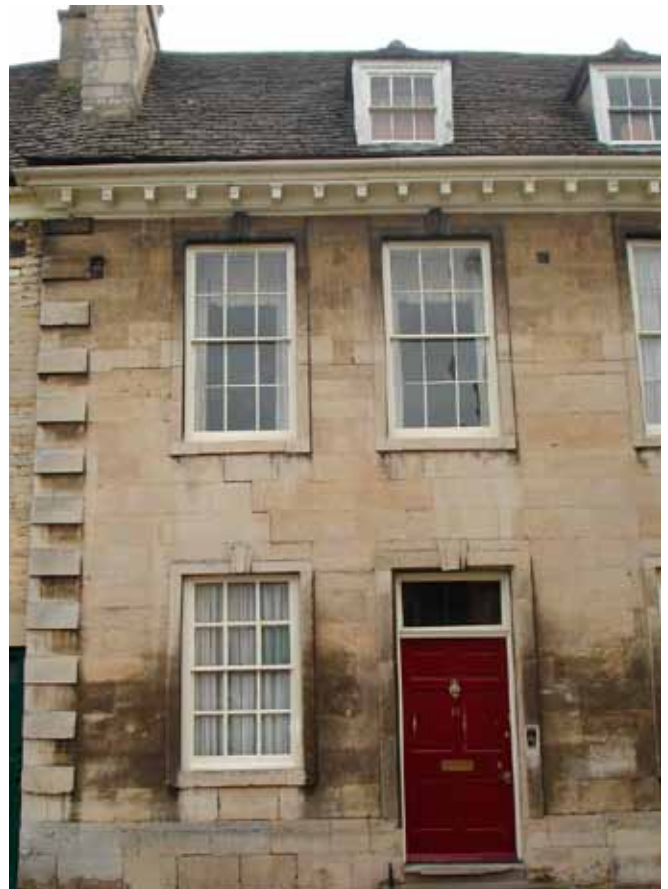
1 When is an EPC Required?

An EPC is required when a property is built, sold or rented. If you are selling or renting a property, an EPC must be ordered before the property is marketed. The EPC is valid for a period of 10 years.

Certain types of building are exempted:

- Listed buildings
- Places of worship
- Temporary buildings (in use for less than 2 years)
- Stand-alone buildings (useful floor area less than 50 square metres)
- Industrial sites, workshops and non-residential agricultural buildings
- Buildings to be demolished
- Holiday accommodation (rented for less than 4 months a year)
- Residential buildings (used less than 4 months a year)

If however, a building that falls into any of the exemptions is being considered for a Green Deal Plan (see [Section 3](#)) then an EPC will still be required as this forms the basis of the Green Deal Assessment.



Listed buildings are exempt from requiring an EPC.

2 EPCs and Older Buildings

An EPC provides a rating system so that comparisons can be made between the energy performance of different properties. It also provides a series of recommendations on how the energy efficiency of the property might be improved.

The EPC is also used as a basis for recommending a package of energy saving measures that can be funded through the Green Deal. It shows which Green Deal measures would be fully or partly funded and the likely repayment costs and subsequent estimated savings on energy bills.

EPCs are generated by a computer software package which takes data from a survey completed on site by a Domestic Energy Assessor (DEA). All EPCs follow the same format for ease of comparison and once complete are held on a central database. The assessment procedure used to carry out EPCs has been designed so that it can be applied to many different forms of building construction in a relatively short time. As a consequence it has to make some general assumptions which often don't take account of the complexity of construction found in many older buildings. This is explained in more detail in Section 4: How is an EPC is calculated?

EPCs do not provide a complete energy audit of a building but focus largely on the energy costs in running a building. The type of fuel source for heating the building and providing hot water therefore has a very significant impact on the EPC rating, much more so than energy saving measures such as secondary glazing or draught-proofing.

2.1 Commissioning an EPC

EPCs can only be provided by a certified assessor who is a member of a Government approved certification scheme for existing buildings. None of the certification schemes make any special provision for assessors working on historic or older buildings. Consequently, enquiries would need to be made to establish the level of experience the assessor has working on older buildings. Although the EPC is a standardised assessment tool, additional experience of traditional construction would be an advantage when surveying the construction of the building and considering what recommendations are appropriate.

2.2 What's different about older buildings?

Older buildings are often thought to be draughty and energy inefficient but they can vary greatly in their energy performance depending how they are constructed and maintained. Many use less energy than some more recently constructed buildings.

A key characteristic of older buildings is the use of permeable building materials which are able to absorb moisture and release it again without damage to the building. By contrast, most modern buildings rely on impervious materials to keep moisture out. Maintaining the building's ability to regulate moisture levels is fundamental to its effective thermal performance.



A



B

A Draught-stripping to windows and doors can provide significant improvements to their thermal performance.

© Core

B Keeping an older building in good repair can help to improve its energy performance.

Older masonry buildings were often constructed with thick external masonry walls as well as masonry internal walls incorporating chimney flues. This form of construction can readily absorb and store warmth as the building is heated. This stored heat is then slowly released as the building cools down.

Protection for older buildings

Older buildings vary greatly in the extent to which they can accommodate change without harming their special interest. Some may be able to accommodate significant change whilst others are sensitive to even slight internal or external

alteration. Before carrying out any energy-saving works to an older building it is important to establish its significant features.

Some buildings or parts of buildings are of such quality, importance or completeness that they should not be altered except in the most exceptional circumstances. If possible, alterations should be designed in such a way so that they can be reversed without damaging the existing fabric. This is especially relevant where changes involve building services which are subject to more frequent upgrading.

Some older buildings, such as listed buildings and buildings in conservation areas are subject to statutory protection so permission may be required before certain works can be carried out.

Improving an older building's energy performance

Whilst almost every older building can accommodate some energy improvements without harming either its special interest or environmental performance, care is needed to avoid measures that might increase the risk of deterioration of the building fabric or harm the character of the building.

Simple measures such as loft insulation and draught proofing can bring about significant improvements. Appliances and fittings (heating systems and controls, hot water heating and lighting) can often be upgraded giving considerable savings without the need to alter historic fabric, although renewing cabling and pipe runs can be disruptive and potentially damaging.

Maintenance is an important factor. An older building that is kept in good repair will generally perform much better than one that is neglected. For example, poorly maintained doors and windows will be draughty, and more heat is lost through a wall that is damp due to leaking gutters.

[For more detail on how to improve the energy efficiency of older buildings see [Section 6](#) for information on current Historic England free guidance.]

3 What Detailed Information Does an EPC Provide?

3.1 Estimated energy costs and use

The EPC estimates the energy costs of the building for lighting, heating and hot water and compares this with potential costs if recommended energy efficiency measures were introduced.

For dwellings, the energy cost estimates represent an 'average household'. They do not take account of factors such as the size of the household; appliance usage or non-standard heating patterns such as any electricity generated by micro-generation.

Performance ratings

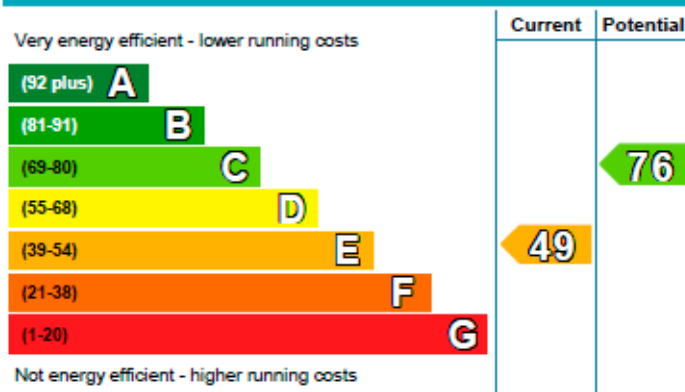
The EPC includes two types of performance ratings:

The first is an **energy efficiency rating** on a scale of 1-100, grouped into bands A-G. This reflects the estimated cost of energy use per square metre of floor space. A rating of 100 indicates that a building will cost nothing to heat and light. It can rise above 100 for homes that generate surplus energy to feed back into the grid.

The second rating is the **environmental impact rating** (CO₂), which measures the building's impact on the environment in terms of carbon dioxide emissions. It is also on a scale of 1-100, and grouped into bands A-G, with a rating of 100 indicating a building with zero carbon dioxide emissions attributed to lighting and heating rooms and water.

The two performance ratings differ because of differences in fuel costs and the amount of carbon emitted. Consequently, a house using a relatively cheap form of fuel, like mains gas, could have a good energy efficiency rating, but still emit more carbon dioxide than a potentially more expensive means of heating, such as bio-gas or bio-mass.

Energy Efficiency Rating



The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

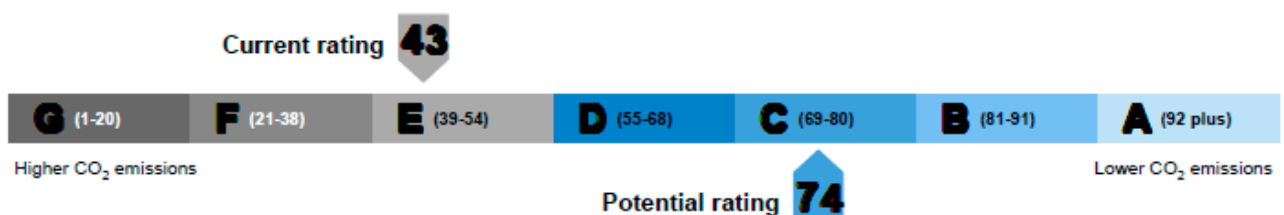
The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

About the impact of buildings on the environment

One of the biggest contributors to global warming is carbon dioxide. The energy we use for heating, lighting and power in homes produces over a quarter of the UK's carbon dioxide emissions.

The average household causes about 6 tonnes of carbon dioxide every year. Based on this assessment, your home currently produces approximately 9.5 tonnes of carbon dioxide every year. Adopting the recommendations in this report can reduce emissions and protect the environment. If you were to install these recommendations you could reduce this amount by 5.5 tonnes per year. You could reduce emissions even more by switching to renewable energy sources.



Top:

The energy efficiency rating is a measure of the overall efficiency of a home.

© DCLG

Bottom:

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

© DCLG

Summary of this home's energy performance related features

| Element | Description | Energy Efficiency |
|-----------------------|---|-------------------|
| Walls | Cavity wall, as built, partial insulation (assumed) | ★ ★ ★ ☆ ☆ |
| Roof | Pitched, 75 mm loft insulation | ★ ★ ★ ☆ ☆ |
| Floor | Solid, no insulation (assumed) | – |
| Windows | Partial double glazing | ★ ★ ☆ ☆ ☆ |
| Main heating | Boiler and radiators, mains gas | ★ ★ ★ ☆ ☆ |
| Main heating controls | Programmer, room thermostat and TRVs | ★ ★ ★ ★ ☆ |
| Secondary heating | None | – |
| Hot water | From main system | ★ ★ ★ ☆ ☆ |
| Lighting | Low energy lighting in 17% of fixed outlets | ★ ★ ☆ ☆ ☆ |

Current primary energy use per square metre of floor area: 298HWh/m² per year

The assessment does not take into consideration the physical condition of any element. 'Assumed' means that the insulation could not be inspected and an assumption has been made in the methodology based on age and type of construction.

© DCLG

Summary of the energy performance related features

The summary of the property's energy performance related features includes the main building elements such as walls, roof, floors, windows, heating systems and controls, as well as the hot water and lighting systems.

A survey description is recorded against each element with an energy efficiency star rating of 1-5 which goes towards providing the building's overall performance rating.

3.2 Recommendations

An EPC includes:



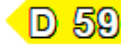

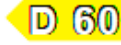

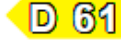






- a list of the top three recommended measures
- a full list of recommended measures
- a list of alternative measures that might also be considered
- a potential Green Deal package of measures
- The first two include indicative costs and typical savings over a period of 1-3 years

Recommended measures

The EPC will contain some of the following recommended improvement measures for improvement depending upon the nature of construction and heating system installed.

These are automatically generated by the software package in the priority order below. Measures can be over-riden by the assessor if they are deemed to be inappropriate for the particular building.

- Loft insulation
- Flat roof insulation
- Roof room insulation
- Cavity fill wall insulation
- Solid wall insulation
- External insulation with cavity wall insulation
- Floor insulation
- Hot water cylinder insulation
- Draught-proofing
- Low energy lights
- Cylinder thermostat
- Heating control upgrade
- Heating system upgrade/recommendations eg biomass boiler
- Fuel change
- Solar water heating
- Waste water heat recovery
- Double glazing
- Secondary glazing
- Insulated doors
- Photovoltaics
- Wind turbine

| Recommended measures | Indicative cost | Typical savings per year | Rating after improvement | Green Deal finance |
|---|-----------------|--------------------------|---|---|
| Increase loft insulation to 270 mm | £100 - £350 | £47 |  |  |
| Cavity wall insulation | £500 - £1,500 | £179 |  |  |
| Draught proofing | £80 - £120 | £26 |  |  |
| Low energy lighting for all fixed outlets | £50 | £43 |  | |
| Replace boiler with new condensing boiler | £2,200 - £3,000 | £339 |  |  |
| Solar water heating | £4,000 - £6,000 | £34 |  |  |
| Replace single glazed windows with low-E double glazing | £3,300 - £6,500 | £41 |  |  |

Alternative measures

There are alternative measures below which you could also consider for your home.

- External insulation with cavity wall insulation
- Biomass boiler (Exempted Appliance if in Smoke Control Area)
- Air or ground source heat pump
- Micro CHP

Choosing the right package

Visit www.epcregister.com/epcadviser.html, our online tool which uses information from this EPC to show you how to save money on your fuel bills. You can use this tool to personalize your Green Deal package.

Directgov
Public services all in one place

| Green Deal package | Typical annual savings |
|------------------------------------|------------------------------|
| Loft insulation | Total savings of £587 |
| Cavity wall insulation | |
| Draught proofing | |
| Condensing boiler | |
| Electricity/gas/other fuel savings | £0 / £587 / £0 |

You could finance this package of measures under the Green Deal. It could **save you £587 a year** in energy costs, based on typical energy use. Some or all of this saving would be recouped through the charge on your bill.

© DCLG

Alternative measures

There is a list of alternative measures which might be considered over and above those in the recommended list. These may include some form of micro-generation such as a heat pump or a low carbon technology like Micro-Combined Heat and Power (CHP).

Green Deal package

The EPC has a section which combines those recommended measures suitable for financing through the Green Deal into a package giving a figure for the typical annual savings per year on energy costs. Some or all of this saving would be recouped through the charge on the electricity bill.

Right:

The Green Deal recognises that for more complex older buildings a more detailed appraisal may be required.



3.3 What is the Green Deal?

The Green Deal is a financing mechanism, rather like a mortgage. It is also a delivery mechanism with accredited assessors and installers. It uses the EPC as a basis for assessing what improvement works might be required for any particular property. If the property has no current EPC then the Green Deal Adviser will undertake an EPC as part of the assessment.

The Green Deal has four basic stages:

Assessment: this is carried out by an accredited Green Deal Adviser, who uses an EPC as a basis for establishing what energy efficiency or micro-generation improvements might be recommended for the property. They will predict the likely energy savings were the improvements to be installed and will only recommend energy saving measures where the expected financial savings are equal to or greater than the estimated cost of the improvements. This is known as the 'Golden Rule'. The measures need to be compatible with the particular property. The assessment also looks at how the building is currently used. This is called an occupancy assessment.

Finance: if a Green Deal offer is taken up, a Green Deal Plan is signed, which is a contract between the owner and the Green Deal Provider who manages the whole process to completion of the installation.

Installation: the Green Deal Provider will arrange an accredited Green Deal installer to carry out the work that has been agreed.

Repayment: the costs of improvements are repaid over time by a charge levied in instalments through the electricity bill.

The Green Deal recognises that thermal upgrading measures for older buildings need to be particularly carefully considered and refers to such buildings as 'vulnerable' buildings. These include:

- Listed and scheduled buildings
- Buildings in conservation areas
- Buildings built before 1914 of traditional construction

The *Green Deal Code of Practice* states that when dealing with vulnerable buildings the Green Deal Provider must take particular care to ensure that:

- The proposed improvements are appropriate for the building
- The finishes and fabric of the building are protected from damage resulting from installation of the improvements by using appropriate materials, products and specifications

The Green Deal also recognises that for more complex older buildings a more detailed appraisal may be required from an architect or surveyor with specialist knowledge of older buildings and if the Green Deal Provider is in doubt about this they must consult the local authority historic buildings or conservation officer.

4 How is the EPC Calculated?

The UK has used the Standard Assessment Procedure (SAP) system for many years to rate the energy efficiency of dwellings. To help speed up the EPC process a Reduced Data SAP (RdSAP) was developed and introduced in 2005. This has since been amended with the latest version introduced in April 2012.

The RdSAP process is designed to strike a balance between accuracy, which requires a more detailed assessment of the building, and the cost of the survey, which is lowered by making more assumptions. The system of assessment must also generate consistent results from all energy assessors, so the amount of specialist knowledge required to produce a rating is minimised.

The RdSAP model makes an estimate of energy performance based primarily on the age of construction. Its accuracy however is limited when applied to assessing the energy performance of older buildings. For example, the model makes certain assumptions about all buildings constructed before 1900 that are often not applicable to all buildings of this period, such as:

- all ground floors are suspended timber and unsealed
- all brick walls are of the same thickness
- all stone walls are uniform and of the same thickness
- no walls are made of earth
- all timber-framed walls are un-insulated but well-sealed

- there is no draught proofing
- all roofs are tiled or slated and have roofing felt
- buildings have one of three fixed proportions of window area

A study carried out by English Heritage in 2007 compared records of energy use in a number of traditional dwellings with their EPC assessments. Typically, the actual energy use was some 40% less than the EPC estimate.

A low energy efficiency rating and a correspondingly high estimate of fuel consumption when applied to traditional dwellings may have a negative effect on a home's perceived value and could trigger a programme of unnecessary and potentially damaging improvements. Conversely, ratings which are inaccurately high in some traditional dwellings, could result in certain improvement works not being carried out which could actually be beneficial.

Vendors could commission a full SAP survey by a qualified surveyor if faced with poor efficiency ratings in an EPC. While this cannot replace the legal requirement for an EPC rating generated by RdSAP, it would provide prospective purchasers with a more accurate rating, although not necessarily a higher one. This may be worthwhile when vendors have already made energy efficiency improvements which will not be taken into account by RdSAP (eg draught-proofing, floor insulation) or when their buildings have certain features which are conducive to good energy

performance (eg thick walls or a thatched roof) which are again not considered.

Even a full SAP assessment still relies on making assumptions about an existing building. A more accurate assessment can be achieved by conducting a more detailed energy survey with on-site tests and measurements such as a fan pressurisation test to measure air-tightness or a U-value measurement for a wall. These tests are compulsory for all new housing and specialist firms offering this service can be found in most regions.

Recent research has shown that the default U-values for mass masonry walls used in assessment calculations have been found to be consistently higher than U-values measured in-situ. The result being the thermal performance of the wall appears to be worse than it really is. Furthermore, air pressurisation tests on traditional buildings sometimes give results that are well within the standards currently required by the Building Regulations.

Fuel consumption of any building may be lower than predicted by an EPC as the occupants may choose to keep the heating down, heat fewer rooms or they may have an open fire. In such cases fuel bills could be passed to prospective purchasers rather than commissioning a full SAP. However, fuel bills cannot be used as a substitute for the legal requirement to generate EPCs using RdSAP.

U-values

U-values measure how quickly energy will pass through one square metre of a barrier when the air temperatures on either side differ by one degree.

U-values are expressed in units of Watts per square metre per degree of temperature difference (W/m^2K). The lower the U-value the slower the rate of heat transfer through the barrier, and therefore the better the insulation quality.



-
- A On site tests such as U-value measurements of walls can help in understanding their thermal performance.
- B A fan pressurisation test can help with establishing heat loss from air gaps.
- © Oxley Conservation

5 Considering Recommended Measures

Before deciding whether to implement an energy efficiency recommendation to an older building, the following key issues should first be considered:

- Compatibility with the fabric of an older building
- Conserving the significance of the building
- Obtaining consent for works.
- Cost of the works



It is important to establish whether the measure is compatible with the way the building is constructed.

Where you are considering major alterations, such as solid wall insulation or insulation at roof rafter level to an older building, particularly those where consent may be required for the work, it is advisable to seek the advice of a suitably qualified architect or surveyor who is experienced with older buildings as well as the local planning authority conservation officer.

5.1 Compatibility

It is important to establish whether the measure is compatible with the way the building is constructed. A fundamental difference between modern buildings and those of traditional construction is that modern buildings are designed to keep moisture out with impervious materials (eg cement, plastic membranes etc) but traditional buildings were built to absorb and release moisture through permeable materials such as lime plaster. Fitting impermeable materials into traditional buildings such as foam based wall insulation can change the equilibrium which could cause long term damage to the building fabric.

5.2 Conservation

Older buildings vary greatly in the extent to which they can accommodate change without loss to their special interest. Some are sensitive to the slightest alteration; others may have changed significantly and could accept more. Before making any changes to an older building it is important to understand what makes it special.

Ideally alterations should be designed in such a way that they can be reversed without damaging the existing fabric. This is especially important for building services which are rapidly evolving technologies and subject to more frequent upgrading.

5.3 Obtaining consent for the works

If your building is listed or in a conservation area then certain works may need consent from the local planning authority. Listed buildings, buildings in conservation areas and scheduled monuments are subject to greater controls on development than other buildings. A recommendation in an EPC to make a particular improvement does not remove the need to obtain the appropriate permission or consent to carry out the work. The local planning authority will be able to advise you on whether or not permission or consent is required.

Although the Building Regulations apply primarily to new buildings, and there is no general requirement for all existing buildings to be upgraded to meet these standards, certain works can trigger the need to comply. These include replacement of thermal elements, major refurbishment, alteration, extension and changes of use. However, listed buildings, buildings in conservation areas, and scheduled monuments are exempted from the need to comply with the energy efficiency requirements of the Regulations, where, and to the extent that they would unacceptably alter their character or appearance. In addition 'special considerations' apply to other historic and traditionally constructed buildings.

5.4 Cost

It is important to bear in mind that some works may cost substantially more than the EPC has suggested, especially when undertaken by a suitably competent specialist, and predicted savings may not be as great as shown in the EPC.

6 Where to Get Advice

6.1 Historic England guidance

See: www.HistoricEngland.org.uk/advice/technical-advice/energy-efficiency-and-historic-buildings/

Energy Efficiency and Historic Buildings; Application of Part L of the Building Regulations to historic and traditionally constructed buildings (2011)

Energy Efficiency and Historic Buildings (all 2012)

Insulating pitched roofs at rafter level/warm roofs

Insulating pitched roofs at ceiling level/cold roofs

Insulating flat roofs

Insulating thatched roofs

Open fires, chimneys and flues

Insulating dormer windows

Insulating timber framed walls

Insulating solid walls

Early cavity walls

Draught-proofing windows and doors

Secondary glazing

Insulation of suspended ground floors

Insulating solid ground floors

6.2 Research Reports

Wood, C, Bordass, W and Baker, P, *Research into the Thermal Performance of Traditional Windows* (2009) Glasgow Caledonian University for English Heritage

Rhee-Duverne, S and Baker, P *Research into the Thermal Performance of Traditional Brick Walls* (2013) Glasgow Caledonian University for English Heritage

6.3 Other publications

Historic Scotland, *Fabric Improvements for Energy Efficiency in Traditional Buildings* (2012) www.historic-scotland.gov.uk

Sustainable Traditional Buildings Alliance, *Responsible Retrofit of Traditional Buildings* (2012) www.stbauk.org

6.4 Contact Historic England

East Midlands

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Northampton NN1 5BE
Tel: 01604 735400
Email: eastmidlands@HistoricEngland.org.uk

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