AN ASSESSMENT OF ENERGY TRAINING FOR EXISTING DWELLINGS IN THE UK

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Abstract

This paper will examine the structure and operation of the Standard Assessment Procedure (SAP) and National Home Energy Rating (NHER) energy training in the UK. The NHER's training scheme operates as a Professional Institution examining, registering and monitoring qualified assessors. The paper then describes the training and integration of the three main areas of expertise – building construction, heating systems and the use of Building Research Establishment Domestic Energy Model (BREDEM) software. Particular attention is also paid to explaining the conventions which all assessors must comply with to enable the scheme to be robust and quality assured.

The training courses are divided into those that deal with new dwellings and those that require surveys of existing dwellings. This paper concentrates on existing dwellings. Although the skills required overlap those involved with new dwellings, compliance with Part L of the building Regulations in the new building sector is of prime importance. The certificates that are produced from software for new dwellings are derived from data from plans and specifications are accepted by Building Control Officers as meaning that the SAP of a property has been calculated by an 'Authorised Person.' For exiting dwellings the paper will explain how individuals use practical experience of surveying dwellings and 'intelligent' software to calculate energy ratings, running costs and improvements.

The paper finally examines the objectives of the Assessment of potential Assessors. It is a requirement of registration that all registered NHER Assessors should have satisfactorily completed the examination procedures for the Site or Plan Assessment scheme or both. This requirement is part of the NHER Quality System, which ensures that NHER Assessors are recognised as competent to issue quality assured Energy Ratings.

Keywords: building regulations, energy rating, energy training, national home energy rating (NHER), standard assessment procedure (SAP).

1. Introduction

The National Home Energy Rating Scheme (NHER) was the original energy rating system in the UK. This BSI accredited scheme provides organisations and individual professionals with training, software, information and technical support in order to produce quality energy ratings. In addition the scheme provides tools for in depth energy analysis, stock management and profiling.

NHER Site Surveyors are trained to collect energy efficiency data on site. By the end of the course delegates will:

- Be able to identify and measure the energy efficiency features of a dwelling.
- Understand and identify different types of heating systems and their levels of energy efficiency.
- Know what kinds of improvement measures are best for a dwelling.
- Be prepared for the NHER Site Surveyor Examination.

NHER Site Assessors have all of the skills of a Surveyor, but have received further training on the use of the software. The Surveyor scheme was set up to meet the quality standards of ratings being within 5 points of the correct figure in 95% of cases.

The NHER scheme operates as a professional institution, examining, registering and monitoring qualified Assessors. The training covers three areas of expertise – building construction, heating systems and the use of the Building Research establishment's Domestic Energy Modelling (BREDEM) software. Courses explain the conventions to be used in carrying out NHER and Standard Assessment Procedure (SAP) energy ratings. Courses are run throughout the UK by approved trainers, the Surveyor course been 2 days and the Assessor course 4 days. An examination at the end of the course leads to a nationally recognised qualification.

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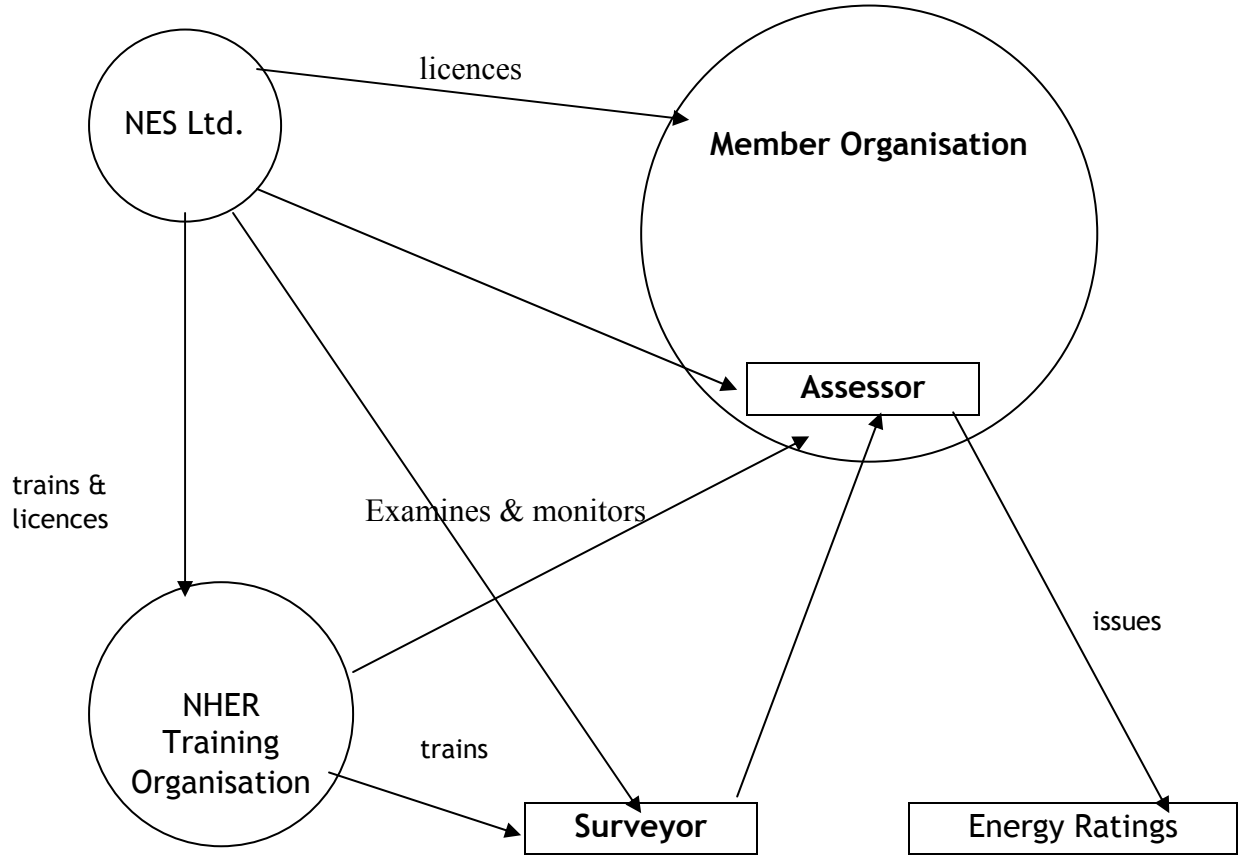
The National Home Energy was the first energy labelling scheme to obtain quality assurance under BSS750 (latterly IS0 9000) and to be fully authorised for delivering SAP Ratings by the DETR. Around a thousand organisations have adopted the NHER. The diagram in Figure 1 shows the main roles fulfilled by NES and how the membership scheme operates.

Figure 1: The NHER Scheme



2. Members, Assessors and Surveyors

NHER Assessors are qualified to issue SAP and NHER certificates. Only qualified registered Assessors may issue certificates carrying the NHER quality assurance and SAP authorisation logo. An Assessor must be employed by a full member of the scheme.
NHER Surveyors are qualified to collect the data on which an NHER or SAP rating may be based. A Surveyor cannot issue SAP or NHER certificates. To have a certificate issued on a property for which a Surveyor has collected the data, the Surveyor must pass the data to an NHER Assessor in an agreed format.

NHER Assessors and Surveyors are required to pass an appropriate NHER examination. The skills needed for rating properties depend on whether the information is already to hand on drawings and detailed specifications, or if a site inspection is needed to collect information, including measurements. The time taken to enter information into the computer program is much less than the time taken to collect it. As a result most organisations undertaking a large amount of ratings employ several Surveyors as collectors, but a smaller number of Assessors who enter the information from other Surveyors (as well as their own information) into the computer program.

The Site Examinations therefore test the ability to collect the necessary information from a site inspection of a property. Site Surveyors are therefore qualified to collect the data required from site inspections. They must pass the data to a Site Assessor before a certificate can be issued.

Site Assessors have all the skills of a Surveyor but have had further training on the software. They must use the NHER Surveyors program to issue SAP or NHER certificates.

The Plan Examinations test the ability to extract information from plans and specifications.

The Plan Surveyors are qualified to collect the data required from plans and specifications. They must pass the data to a Plan Assessor before a certificate can be issued. Plan Assessors have all the skills of a Surveyor, but have received further training on the use of the program. They must use the NHER Plan assessor or Evaluator program to issue NHER certificates and Building Control compliance data.

After passing the appropriate examination an Assessor or Surveyor must sign a license agreement and pay an annual registration fee to be an NHER Assessor or Surveyor. Training is not compulsory for NHER Assessors and Surveyors but they all must pass the appropriate examination. Few people are able to pass the examination without taking a training course due to the detailed feedback on the practice examples provided during the training. Training courses are run by experienced Assessors who all had further training on teaching the information in the manuals. All courses involve a high degree of 'hands on' teaching and practice.

3. The Quality Scheme

NES Ltd operate a quality scheme that ensures that all SAP ratings are delivered within the quality standards required by the DETR. The essential components of the quality scheme are:

1. Quality procedures (now ISO EN 9000) in place for the administration of the scheme, including legal agreement with members.

2. All Assessors and Surveyors need to pass a professional examination.

3. NHER training courses for Assessors or Surveyors are all delivered by approved trainers employed by NHER members.

4. Monitoring the work of all Assessors by requiring copies of all certificates issued to be returned to NES. The monitoring is carried out by checks on properties (including site visits) on properties which have been rated.

5. Government endorsement of its software for calculating ratings. The NHER software is all approved by BRE.

4. Pre-Course Study

Ideally before attending a Surveyor course the delegate will have:

- Read the training manual especially the section relating to completion of the survey form
- Some experience in surveying domestic properties and can identify standard construction types of measuring floor areas.

The candidate with less experience in surveying will need to spend more time reading up some background material. One area that traditionally is difficult is the correct identification of space and water heating systems and their controls. The training manual includes Survey Forms which can be used on practice dwellings to develop the skills required to collect the information.

The NHER scheme is an independently authorised scheme for providing energy information. The NHER scheme involves quality assurance that includes checking the ratings issued by all registered Assessors and Surveyors.

5. Data Collection

The training is also concerned with the accurate completion of a Survey Form. In order for a rating to be calculated using the information collected, the form must be entered into the computer program by a qualified NHER Assessor. When the data has been collected for a large number of surveys, hand held machines can be used. The University of Salford with Property Tectonics used the protocols to develop a template for hand held machines to enable multiple data sets to be analysed.

The Surveyor collects information on the building including some measurements of the insulation present, together with information about the heating, hot water, lights and form of cooking. In order to carry out a rapid but accurate survey there is a considerable amount of intelligence built into the computer program.

Area of walls, floors, roof and windows

In order to calculate the heat loss from the walls, the Surveyor will need to measure the area of the walls. The perimeter and room heights are measured. The program adds on a thickness for the space between the floors, and works out the area of the wall including the windows and door. It is possible to allow the program to 'estimate' the area of the windows for a property of the type and age or alternatively they can be physically measured for increased accuracy.

Where the perimeter of the upstairs is different from downstairs, the intelligence built into the program will still accurately estimate the upper floor areas using the difference in floor areas, and the property type such as terrace with passage.

It is necessary for the Surveyor to follow the Rules' or Conventions' to ensure that all Surveyors end up with the same result.

Boilers and heating

The program includes a database – Seasonal Efficiency of Domestic Boilers in the UK (SEDBUK) of gas boiler names which is used to work out the efficiency of each boiler type.

U-values

For new properties where full drawings are available, the U-value would normally be calculated by the combined method as part of the energy assessment. For existing properties we assume values for the heat losses based on glazing type, insulation levels and age. So for instance a single glazed wood window would have a U-value of 4.7W/m^2K, a wall built in the 1977-81 period would be assumed to have a U-value of 1.0W/m^2K. If the wall had cavity wall insulation fitted, the new U-value becomes 0.44 W/m^2K, a reduction in heat loss of 66%. The Assessor has the option in the program of inserting a U-value directly, for a construction type which doesn't fit any of the normal options, such as concrete.

Built form

The categories of built form apply only to houses and bungalows (flats are covered separately). Most of the built form categories are fairly obvious. Although end-terraced and semi-detached properties are similar in terms of exposed walls there is a slight difference in the calculated window area over the two built forms. It is important to get the built form

correct where passages are involved since the program has to work out the upper floor perimeter from the ground floor information. Entering mid terrace instead of a terrace with passage may result in a SAP error of 5 or 6 points.

Age

The house age is required for the calculation to select the default values for the wall, roof and floor U-values and to calculate the window area. Houses of different ages have different window to wall and window to floor ratios. If the house has an extension the age of the extension also needs to be entered. In this context the training involves indication of stylistics clues from a series of photographs.

Heat loss areas and perimeters

The survey requires the floor area of the house and that of any extension for each storey of the dwelling. The floor area required is that calculated from the external or internal measurements of the dwelling. Great accuracy is not needed and small chimney breasts and small bay windows can be left off the required sketch plan. This sketch plan must be dimensioned as well as having the position of adjacent buildings, garages and extensions.

The plans are used by the Assessor to check the data entered into the floor area and perimeter sections of the survey form. The floor area is required for each storey, with the area of basements and rooms in the roof. The ground floor area must **not** include any:

- Integral or adjoining garages.
- Stores, coal sheds or other external unheated spaces.
- Unheated conservatories.
- Unheated porches outside the main building.

Perimeters

The heat loss perimeter of the house and that of any extension or conservatory has to be entered separately. The exposed perimeter is extremely important for evaluating wall areas as well as the heat-loss through the ground floor so it is essential that it is measured accurately.

Rooms in the roof

To enter rooms in the roof over ½ the storey must be made up of such rooms. Some properties have rooms partially built into the roof space – they have some walls in common with the floor below, but also have sloping ceilings and corner windows or roof lights (referred to as ½ wall room in the roof). The convention for this ½ wall is where the height of the exposed wall is greater than 0.6m and less than 1.8m. The significance of this is that there is a significant additional wall area associated with this construction. Where the exposed wall is the same as or greater than 1.8m then the sloping ceilings are ignored and the room(s) entered as a separate storey.

Rooms and chimneys

The number of rooms is straightforward as is chimneys. When assessing the number of chimneys in a property the count includes:

- Open chimneys with no appliance installed
- Open chimneys with a non-flued appliance (e.g. open fire)
- Temporarily closed chimneys with or without ventilation (chimneys assumed to have diameter greater than 200mm or equivalent).

Room heights are important in the calculation of wall areas and volumes. The surveyor would be expected to use common sense in estimating an average room height for a storey of dwellings with different room heights.

Wall construction

Identifying insulation levels and wall construction type is a crucial part of the assessment process. The options for the data collection are stone, solid, cavity, filled cavity, timber frame or other. 'Other' would normally be used for forms of non-traditional construction e.g. an 'Airey House'. The wall construction type is used in two ways. Where the 'external' measurements are used to calculate the 'internal' areas the wall construction type thickness is used. So when stone is entered the program assumes that the walls are 600mm thick. The other use of wall construction is to calculate the U-value. In the case of masonry construction they may have been improved with cavity fill, internal lining or external insulation. Timber frame walls were often built to higher standards than Building Regulation requirements of the time which are reflected in the following Table 2.

Table 2: U-values assumed by NHER Survey for England & Wales

Age	Stone	Solid	Cavity	Timber Frame
Pre 1900	2.12	2.12	2.12	2.5
1900 - 1929	2.12	2.12	1.6	1.9
1930 - 1949	2.12	2.12	1.6	1.9
1950 – 1965	2.12	2.12	1.6	1.0
1966 – 1976	1.5	1.5	1.5	0.8
1977 – 1981	1.0	1.0	1.0	0.45
1982 – 1989	0.6	0.6	0.6	0.35
1990 – 1995	0.6*	0.6*	0.6*	0.35
1995 +	0.45	0.45	0.45	0.35

* If double glazed otherwise 0.45

The surveyor should look at the brick pattern and measure the wall thickness including plaster e.g.

Brick pattern – stretchers only and 260 – 275 mm thick – cavity, filled cavity or timber frame.

- Headers and stretches in regular patterns. 220 – 240 thick solid masonry wall
- Headers and stretches in regular patterns, and 340 to 350mm thick – solid masonry wall (brick and a half)

The Surveyor must therefore be able to distinguish brick clad timber frame from brick cavity. A timber frame will sound hollow as will a masonry wall drylined on dabs. The solid dabs will however be able to be identified as ‘more solid’ than timber studs. Also look in the loft space and the sheathing material at the gable will be fairly obvious. Other clues that the surveyor will identify are in brick clad timber frame houses built since 1983 open perpends below dpc and below the eaves are another sign of a timber frame. Another clue is in the window position which, in timber frame houses is often set back in line with the timber frame.

Cavity wall insulation

These techniques use 25mm holes drilled into the mortar points (usually at the junction of the perpends and the bed points). These holes are filled with matching mortar and in many cases close inspection is required to see the holes. The holes tend to be in a regular pattern about 1.0m – 1.5m apart over most of the wall, but closer under eaves and windows. Other clues which the Surveyor can use include:

- If there is a gable wall, inspection of the loft space can show small clumps of insulation forced through the mortar joints.
- The cut bricks may also have been replaced with newer ones, or may have been 'sleeved' with mineral wool quilt or by other means.
- Insulation may also be visible in the gaps around meter boxes.

Roof type and insulation

The roof type specification is straightforward. The entry affects the insulation thickness and this is measured when inspecting the roof space. Where the loft space is inaccessible or where there is a flat roof, select the 'don't know' option, then this will default to the standards applicable due to dwellings age.

Windows

The percentage area of frame and glazing type is required. This information is required for the whole dwelling including any extension.

Heating details

Usually a house will have a main heating system, such as a boiler and radiators and a secondary heating system such as an open fire. The survey has to establish the main heating system. The following rules are used to establish which is the main heating system.

Primary heating system

- Select the system supplies heat to the most rooms and which preferably also provides water heating.

- If in doubt select the non-room heating system. This is because a boiler and radiator system, or storage heaters, cannot be entered in the program as secondary heating.
- If still in doubt, select the system that supplies most heat to the living room.

For gas heating, the make of the model of the boiler is also obtained as this is used to calculate efficiency of the system. In addition to the make and model number the flue type (open, balances or fan assisted), mounting (wall or floor) and type of boiler (normal, condensing, combi or back boiler) is required.

A combi boiler is distinguishable by:

- More pipes entering the boiler (5 or 6 instead of 3)
- The boiler firing when the hot water is turned on
- A pressure gauge on the boiler
- A hot water cylinder

A condensing boiler is identified by:

- A plastic drain pipe (30mm or 20mm diameter) from the boiler to a suitable drain, internal or external.
- All condensing boilers have a fanned flue.
- On a cold day in winter steam may be coming out of the flue terminal.

Gas room heaters (mainly post 1970) which can be balanced flue, or open flue convector and radiant heaters. For a gas fired back boiler that feds radiators the make and model should be shown.

The heating system type is fairly obvious with ‘other system types’ covering under floor heating fed from a gas or oil boiler. For storage heaters, the old large ones are often brown and have typically been installed in the 1960’s. Modern heaters are all the slim-line models, fan assisted heaters have a room thermostat control and a fan to extract more heat from the appliances.

The secondary heating can include gas or coal fires in the living room. It is also important for the Surveyor to recognise a popular form of secondary heating – 'live coal' or gas flame effect fire as they have different efficiencies. A gas flame effect fire open to a chimney only has an efficiency of 25% while a gas flame effect fire flued with a diameter of less than $0.05m^2$ connecting it to a chimney has an efficiency of 50%. The difference between these two can be as much as 8 SAP points.

Heating controls

This includes the correct identification of cylinder thermostats, room thermostats and programmer. If there is more than 1 thermostat then the property has zoned heating. The number of thermostatic radiator valves (TRV's) is also required.

Water heating

In the majority of cases hot water heating will be from the main heating system or by immersion heater. The cylinder size with the amount of insulation is required.

Additional information and measures not to be recommended

The cooker type and if any rooms are fitted with low energy lights is required along with details of any mechanical ventilation system. The Surveyor is also expected to mention measures that are not recommended. For example, cavity fill with poor brickwork and high exposure. Sketch plans are also required and this helps to calculate the floor areas and perimeters. It is also useful for the Assessor to refer back to the sketch plans to check entries.

Extended Data

A number of extended data items' can be collected to further improve the accuracy of the rating.

- There is an opportunity to adjust the exposure if it is different from that derived by the postcode. Since these factors can only be an average for the area covered by the post code, the Assessor should check the assumptions that the program makes.
- Floor details. Information is required on the floor type (solid, beam and block, suspended timber etc. If suspended timber there is an opportunity to allow for sealing against draughts and the thickness of the insulation should also be entered.
- Opening data. The data required is area, Frame material, draughtproofing details, wall type included in, and whether the window or door has single, double or triple glazing

and gap size and whether there is a low e coating or argon filling. The overshading in zone 1 (better heated zone) or zone 2 (the rest of the dwelling) should also be obtained.

- Ventilatiom. The additional data items for ventilation include the number of sides sheltered, L50 pressure test result, draught lobby, main stairs in the Living Room, loft hatch (draught proofed or not), number of extract fans, flues, chimneys and mechanical ventilation.
- Occupancy data and heating pattern. It is possible to specify a built in standard pattern or the demand temperature can be set with the % of zone 2 heated. The exact number of adults and children can also be specified. The extended data for heating systems also includes an interlock test which checks if the boiler switches off when ther is no demand for heating.

6. Site Surveyor Examination

The aim of the NHER Site Surveyor Examination is to provide clear evidence that the candidate can accurately complete a NHER Site Survey Form for a dwelling and are aware of the underlying logic of the energy survey. The examination is therefore a demonstration of competence test.

Historically the pass rate for the NHER examinations has been around 90% and those who fail often only fail one component and can resit that in order to obtain a pass. The NHER also recognises a category of 'borderline fail' where a candidate has demonstrated a basic level of understanding, but needs to revise certain aspects of the training manual. Borderline Fail candidates are required to answer some additional postal questions in order to qualify.

NES requires that all registered NHER Site Surveyors should have satisfactorily completed the examination procedures associated with the NHER Site Surveyor examination. This is part of the NHER Quality System, which ensures that NHER Assessors are recognised as competent to issue quality assured ratings.

The examination scheme has two parts. The first is a 50 minute written examination paper. The examination paper covers general aspects of understanding the SAP, hoe they are assessed and the factors that affect them most. The paper also uses photographs to test the

candidate's ability to recognise buildings and heating systems and controls. A section on when NOT to recommend improvement measures is also included.
The second is a practical survey of an actual dwelling carried out under examination conditions. The Examiner will witness the survey being carried out and will require the survey forms completed during the survey. The Examiner will also interview the candidates, asking questions about how they identified or measured various items, and also about any special issues associated with improving the dwelling. There is about 45 minutes available for completing the survey and a further 10 – 15 minutes for the interview.

The standards required in all these assessments are such that the candidate is capable of carrying out an accurate NHER survey of a dwelling from a site visit. The guidance issued to the Examiners is that a score of 75% is usually expected in order to pass the written paper.

In the practical examination the candidates should not make more than 1 major error and not more than 5 minor errors. A major error is one that affects the SAP by more than 5 points; a minor error is any other error in data collection. A tolerance is accepted on dimensional entries. The main objectives to be covered by the assessment scheme are:

The surveyor should be able to:

1. Recognise true and false statements about and offer correct explanations of the factors that affect SAP.
2. Explain how an energy rating is calculated in principle (equations not required).
3. Identify different built forms.
4. Identify the approximate age of a dwelling given its overall appearance and information on the construction of the walls, floors and roof.
5. State the definition of an extension within the HNER conventions; recognise when a dwelling should be recorded as having an extension.
6. Evaluate the number of storeys in a dwelling and be able to correctly distinguish between additional storeys and rooms in the roof.
7. Identify different types of wall construction and know the tests to be applied to establish each type. Recognise when a cavity wall has been filled and be able to give a list of indicators to look for to establish this.
8. Identify different floor and roof constructions.

9. Identify different window frame and glazing types.
10. Identify common heating systems and to know what controls to look for in association with each system.
11. Identify secondary heating systems and be able to decide which is the primary and secondary heating in a given dwelling.
12. Measure and describe how to measure, loft insulation thickness and hot water insulation thickness.
13. Draw an approximate floor plan of a dwelling from a site survey and derive the floor area of each storey and the exposed perimeters of house and extension on the ground floor.
14. Correctly identify unheated conservatories, integral garages and other unheated spaces associated with dwellings and include any walls between the dwelling and such unheated spaces in the exposed perimeter.
15. Identify examples where a dwelling can be improved to provide a better energy performance at a reasonable cost. This includes recognising the importance of all round insulation, efficient heating and good heating controls and the approximate cost of measures.
16. Provide examples of when cavity fill, draught stripping and loft insulation are unwise inappropriate measures.
17. Recognise the internal heat loss perimeter, external heat loss perimeter, exposed roof and floor areas for flats.
18. Correctly complete a NHER Site Survey Form.

For Assessors there are additional Objectives covering issues around the BREDEM model and the computer program.

7. Conclusions

This paper has examined the training requirements for Energy Surveyors and Assessors in the UK under the NHER scheme. The main skills required are knowledge of building construction, heating systems and surveying skills in the residential sector. Careful attention has to be paid to BREDEM and other conventions in order to make the training robust and enable different Surveyors to produce the same quality assured results. The skills required to work with existing dwellings and data derived from plans overlap but a clear logical

surveying technique is of paramount importance. The training for Energy Surveyors and Assessors is under the auspices of the NHER who have a body of recognised trainers.
The trainers should develop an awareness of the type/level of delegate/candidate presenting themselves for examination. The training can then be tailored to the group as a whole e.g. generally the majority are existing Surveyors with only an 'overview' knowledge of heating systems and their controls. The trainer should therefore make sure that this area of training is given special attention within the course. The examination objectives cover both the practical and theoretical skills and knowledge required to perform as a competent person to deliver quality assured energy ratings. The requirements for these examinations have been clearly identified.

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