

Buan Ionadaíocht
na hÉireann
chuig an Aontas Eorpach



Permanent Representation
of Ireland
to the European Union

Mr. Paul Hodson,
Head of Unit,
Directorate General Energy (C3),
European Commission,
B-1049 Brussels,
Belgium.

13 May 2014

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A/				
ACTION:		ÉCHÉANCE:		
CODE DOSSIER:				
15-05-2014 (C3)				
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DBC	DCDE	DDE		

Re: Article 18 of Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings (recast)

Dear Mr. Hodson,

I have been asked by my authorities to refer to the Commission's correspondence of 21 March 2014 {Ref: ENER/DR/LD/ba (2014) 510629} which concerns the monitoring of independent control systems in accordance with the provisions of Article 18 of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast).

My authorities note the importance of collecting accurate information on the operation of the provisions on independent control systems as required under Article 18 of Directive 2010/31/EU as a means of assisting the Commission in its assessment of the European Union's progress towards the achievement of its energy efficiency objectives for 2020 and in its review over the course of this year of Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency.

In this context, my authorities have completed Section 1 (Independent Control of Energy Performance Certificates) of the Commission's questionnaire which is enclosed for your information together with a report on the implementation in Ireland of the requirements on independent control systems for energy performance certificates. It is hoped that the information provided in this questionnaire will be of assistance to the Commission in its work on the energy efficiency agenda.

It is noted that Section 2 of the Commission's questionnaire relates to the independent control of inspection reports for heating and air-conditioning systems. It is further noted that Article 14 of Directive 2010/31/EU on the energy performance of buildings (recast) requires Member States to either provide for the regular inspection of the accessible parts of systems used for the heating of buildings or to submit a report to the Commission on equivalence measures which is to be updated every three years. Article 15 of the Directive makes provision for the application of similar arrangements in respect of air-conditioning systems.

In the case of Ireland, the alternative arrangements provided for under Articles 14(4) and 15(4) of the Directive have been availed of and equivalence reports have been submitted to the Commission in respect of both heating and air-conditioning systems. Against this background, I have been asked to confirm that Section 2 of the Commission's questionnaire is not applicable to Ireland given my authorities have availed of the alternative arrangements provided for under Articles 14(4) and 15(4) of the Directive respectively.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'Pat Fenton', written in a cursive style.

Pat Fenton
Environment Attaché

Enc. Report on Ireland's implementation of Independent Control System requirements (Article 18 and Annex II of the EPBD Recast)



Report on Ireland's implementation of Independent Control System requirements (Article 18 and Annex II of the EPBD-Recast)

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1. Overview

The EU Energy Performance of Buildings Directive (EPBD) and subsequent Recast Directive, transposed into Irish Law from 2006 onwards, contain a range of provisions to improve the energy performance of new and existing buildings. Among the Directive's provisions EU Member States must ensure that an Energy Performance Certificate, or Building Energy Rating (BER) in Ireland, is issued for buildings or building units which are constructed, sold or rented to a new tenant. The objective is to provide trustworthy information to potential buyers and tenants about the energy performance of a building, and to allow for comparisons between buildings, informing property selection and informing investment decisions thereafter.

In Ireland progress on the implementation of the Building Energy Ratings scheme is overseen by a cross-departmental Implementation Group comprising senior representatives of the Department of the Environment, Community and Local Government, the Department of Communications, Energy and Natural Resources and the Sustainable Energy Authority of Ireland (SEAI).

SEAI is designated within the transposing legislation as the Issuing Authority responsible for administering the BER system and its roles include:

- Managing DEAP (domestic) and NEAP (non-domestic) calculation methodologies and software;
- Maintaining a central database of BERs;
- Setting rules for training and registration of BER assessors;
- Setting rules for BER publication and maintenance of records;
- Overseeing an assessor Code of Practice and Quality Assurance (QA) regime;
- Providing helpdesk facilities for assessors and general public;
- Providing consumer awareness and advocacy promotion.

There are now more than 445,000 BERs on the public register, which represents nearly a quarter of the residential housing stock.

Extensive measures have been put in place to ensure that enough BER assessors are trained and that they can perform accurate assessments. The pre-qualification requirement for BER assessors of domestic buildings is a Quality and Qualifications Ireland (QQI) Level 6 Award in construction studies or equivalent. Training providers must be registered with a national accreditation body. The training programme must meet SEAI's BER training specification in full.

QA is regarded as a vital reputational issue to give the market confidence in the certificates published, and is resourced accordingly. The QA framework put in place by SEAI has three strands:

- Upstream, including assessor pre-qualification, training and the national examination;
- In-line: calculation tool features and output validation checking of BERs prior to publication;
- Downstream auditing of published BERs, disciplinary procedure and technical advice.

The following report demonstrates how Ireland complies with the requirements of Article 18 of the Recast Directive and comprises:

- Formal template report in accordance with European Commission request (March 2014);
- Overview of Ireland's BER quality assurance framework;
- Details of the random sampling methodology;
- Full process details for a Documentation and Practice Audit (meeting option c of Annex II of Recast Directive);
- Calculation methodology for statistically significant sample.

2. Independent Control of Energy Performance Certificates

In accordance with the Commission's template and request dated 21st March 2014.

Independent control of Energy Performance Certificates	
Responsible body for the control	Sustainable Energy Authority of Ireland (SEAI)
Total number of certificates issued in 2013	104,785 (Domestic and Non-domestic)
Total number of randomly selected certificates selected for verification purposes in 2013	288 (Statistically significant sample size for Q2, Q3 and Q4 for 2013)
Amongst these, number of certificates following: <ul style="list-style-type: none"> • Option a of EPBD-recast, Annex II, Point 1 • Option b of EPBD-recast, Annex II, Point 1 • Option c of EPBD-recast, Annex II, Point 1 • Other equivalent measure (if any, please provide an additional description of the applied verification measure) 	a – all for residential BERs ¹ published c – for a statistically significant sample Full details of all Quality Assurance activities undertaken in 2013 supplied in attached report.
If any, total number of certificates selected in 2013 for verification purposes, in addition to the certificates selected on a random basis	430

¹ In Ireland, energy performance certificates are known as Building Energy Rating (BER) certificates.

3. BER Assurance Framework

The primary objective of the BER assurance framework is that the BERs published on the National Administration System (NAS) are a reliable reflection of the energy performance of the property.

The framework has three distinct pillars:

- assessor qualifications and competence;
- calculation tools and systems; and
- quality assurance and continuous professional development

The assurance framework represents an integrated approach, comprising a number of filters, checks and guidance, ensuring that eligible and competent assessors complete ratings properly and accurately.

3.1. Assessor Qualifications and Competence

Domestic Assessors:

- Prior qualifications for training eligibility are set by SEAI.
- SEAI publish the Training Specification with prescribed learning outcomes to be delivered by trainers accredited by Ireland's *Quality and Qualifications Ireland* (formerly the *Further Education and Training Awards Council*) with minimum requirements for exit test.

Non-Domestic Assessors:

- To be eligible, an assessor must have a level 7 degree in a construction related discipline and must be a member of a prescribed professional body.

All Assessors:

- All assessors must achieve a 70% pass mark at initial registration and every two years thereafter in the National Examination administered by a 3rd party on behalf of SEAI.
- Upon registration the assessor accepts Terms and Conditions set down by SEAI.
- Assessors commit to compliance with the BER Assessor Code of Practice published by SEAI.
- Assessors must have vouched tax clearance and insurance cover on a continual basis.

3.2. Calculation Tools and Systems

- SEAI defines the calculation methodology.
- SEAI provides mandated software calculation tool (free of charge) to all assessors accompanied by user manuals and survey guide. Where possible, data entry is subject to validation, to minimise entry errors.
 - Extensive additional help / guidance resources are available both within the tool and online.

- During the upload process all DOMESTIC ratings are subject to a range of normative data checks. New properties are also tested for Building Regulations (energy) compliance. (This is not currently possible for Non-Domestic ratings).

3.3. Quality Assurance and Continuous Professional Development

- SEAI operates a helpdesk with Tier 1, 2 and 3 support for assessors, mostly dealing with technical issues or exceptional matters arising on particular properties.
- SEAI undertakes audits through a panel of externally appointed expert auditors on a large sample of published ratings. These include:
 - Data Reviews look at specific data-points on a single rating, selected on a random basis. (Low intensity, domestic BERs only).
 - Desk reviews look for patterns or anomalies across a number of ratings by a selected assessor. Selection is risk based. (Medium intensity, domestic BERs only).
 - Documentation and Practice Audits are full end to end audits of complete ratings carried out on site or at the BER assessor's premises. Mostly selected on a targeted / risk basis. (Very high intensity, domestic and non-domestic BERs).

The Random Audit Sampling Methodology and the Quality Assurance Audit Sampling Procedures are detailed below in Appendix A and B respectively.

- Non-compliances identified are ranked by severity and may result in rating revocation and assignment of penalty points. Accumulated penalty points will lead to sanctions including deregistration. Assessors can also be deregistered for specific non-compliances with either the legislation or the Code of Practice.
- SEAI publishes approximately four Assessor Technical Bulletins each year, addressing issues frequently identified in audits or matters raised through the helpdesk or the introduction of new features / requirements.
- SEAI has published seven video tutorials on a number of high importance aspects of BER assessments.

3.4. BER Assurance Framework Summary

The following table summarises the BER Assurance framework used in Ireland.

	Domestic	Non-domestic
Assessor Qualifications		
Training Specification	X	
Prior Qualifications	X	X
FETAC (now QQI) Accredited trainers	X	
Membership of Professional Body		X
National Examination (entry and biennial repeat)	X	X
Registration Terms and Conditions	X	X
Assessor Code of Practice	X	X
Vouched Insurance	X	X
Vouched Tax Clearance	X	X
Calculation Tools and Systems		
Defined methodology	X	X
Software tool supplied by SEAI	X	X
User manuals and survey guide	X	X
Data entry validation	X	X
Software help and guidance tips	X	X
In-line publication validation tests	X	
Building Regulations compliance checks	X	X
Quality Assurance and CPD		
Helpdesk for assessor technical queries	X	X
Sample Data Review Audits	X	
Sample Desk Review Audits	X	X
Sample Documentation and Practice Audits	X	X
Penalty points and sanctions process	X	X
Assessor Technical Bulletins	X	X
Video Tutorials	X	

Appendix A: BER Quality Assurance Random Audit Sampling Methodology

Purpose:

This procedure details the methodology supporting the approach to calculating the statistically significant random sample size which is then used in the selection of BER assessments for audit.

Scope:

This document is intended for use by SEAI in demonstrating the methodology used to derive the statistically significant random sample size.

Responsibilities:

The BER Quality Assurance manager is responsible for documenting this procedure with approval from the BER Quality Assurance continuous improvement team.

References:

- Code of Practice for BER Assessors.
- BER Quality Assurance System and Disciplinary Procedure.
- European Union (Energy Performance of Buildings) Regulations 2012 (S.I. No. 243 of 2012).
- Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings (recast)
- BER Quality Assurance Audit Sampling Procedures document.

Background

The BER Assurance framework has a fundamental objective that the BERs published on the National Administration System (NAS) are a reliable and faithful reflection of the energy performance of the subject property. The full implementation of the Quality Assurance Programme comprises an integrated approach to ensure that good assessors undertake ratings properly and it entails a combinations of filters, checks and guidance.

Quality Assurance and Auditing

SEAI undertake audits (through a panel of externally appointed expert auditors) on a large sample of published ratings. These include:

- Data Reviews (low intensity, higher volume).
- Desk reviews (risk analysis, medium volume).
- Documentation and Practice Audits (Very high intensity, moderate volume). This latter type involves the assessor in a detailed granular analysis of every data point in the rating and as such is effectively a coaching / mentoring exercise.
- Documentation and Practice Audits. Reduced data set (Medium intensity, high volume). This audit type reviews a standard reduced data set of the most sensitive to change data points/most frequency occurring items found in audits.

Non-compliances identified are ranked in order of severity and may result in rating revocation and assignment of penalty points. Accumulated penalty points will lead to sanctions including deregistration. Assessors can also be deregistered for failure to comply with requirements set down in either the legislation or the Code of Practice.

Audit Selection Principles

Selection of BER Assessors for audit is on both a targeted and a random basis with due consideration of anomalies / risks in ratings.

Random auditing

The goal of random sampling auditing is to determine if the process (the publication of ratings by BER assessors) is capable of consistently publishing ratings which accurately² reflect the energy performance of a building. An additional goal is to determine important sources of variation for use in the development of a process control strategy and also to inform the approach to targeted sampling.

Annex II (Independent control systems for energy performance certificates and inspection reports) of Directive 2010/31/EU provides –

1. *The competent authorities or bodies to which the competent authorities have delegated the responsibility for implementing the independent control system shall make a random selection of at least a statistically significant percentage of all the energy performance certificates issued annually and subject those certificates to verification.*

The verification shall be based on the options indicated below or on equivalent measures:

- (a) validity check of the input data of the building used to issue the energy performance certificate and the results stated in the certificate;*
 - (b) check of the input data and verification of the results of the energy performance certificate, including the recommendations made;*
 - (c) full check of the input data of the building used to issue the energy performance certificate, full verification of the results stated in the certificate, including the recommendations made, and on-site visit of the building, if possible, to check correspondence between specifications given in the energy performance certificate and the building certified.*
2. *The competent authorities or bodies to which the competent authorities have delegated the responsibility for implementing the independent control system shall make a random selection of at least a statistically significant percentage of all the inspection reports issued annually and subject those reports to verification.*

Targeted auditing

The goal of targeted sampling auditing is to look for patterns or anomalies across ratings. Ratings / assessors are selected on a targeted basis. Again an additional goal is to determine important sources of variation for use in development of a process control strategy and also to inform the approach to random sampling.

² The audit outcome demonstrates that the rating is either compliant or warrants a Severity 3 finding (i.e. a minor non-compliance).

Audit Selection Procedure

Random selection of audits

Under the BER Quality Assurance Random Sampling Methodology, the sample size is calculated on the basis of the number of BERs published per annum.

- The selection of BERs for random sampling is completed at the end of each quarter Q1, Q2, Q3 and Q4.
- Audits are selected at random in respect of ratings published in the previous quarter, e.g. audits selected randomly in Q3 will review ratings published in Q2.
- A list of BERs published in the selected quarter is generated for 'Published' and 'Not expired' BERs.
- BERs that have been audited previously through targeted audit selection are removed from selection.
- New Provisional BERs³ are removed to leave only Final BERs.
- Random numbers are generated for the remaining BERs.
- As the random number generator is a dynamic calculation, the random numbers generated are copied into text format.
- The random numbers are then sorted in descending order which selects BER numbers randomly as illustrated in the example below:

BER number	Random number generator (sorted in descending order)	Random Audits
105156210	0.999898559	1
105377378	0.999872554	2
105209639	0.999799257	3
105331854	0.999790822	4
105299101	0.999782407	5
105274310	0.999756608	6
105175624	0.99972098	7
105209910	0.999699804	8
105282107	0.999672056	9
105223846	0.999666363	10

- 96 BER numbers are required to be selected in order to meet the statistically significant sample with a confidence level of 95% and a margin of error on the result of +/- 5% when randomly selected as above for each quarter.
- Based on operational feedback from the initial batch of 96 (Q2 2013 – (384/4) audits) an upside of 10% is required to meet the requirements of 96 audits.
- A full documentation and practice audit is carried out on site accompanied by the BER assessor for each BER (where possible), selected at random for audit.

³ A provisional BER is required when a new building is being offered for sale or for rent off plans. On completion of construction works, a final BER is required in advance of finalising the sale or rental transaction.

- In generating a random list of BERs, BER assessors may receive 1 or more BER audits. (Sanctions arising from audits should be considered relative to the number of audits received within a 28 day period and the non-compliances detected).
- A BER Assessor should not receive more than 2 random audits in a particular quarter.
- In the case where a BER Assessor has been selected for more than 2 audits as part of the random audit selection process, the number of random audits will be reduced to 2 for a given period and the BER Assessor will be considered for additional audits as part of the targeted audit selection process. The next BER Assessments randomly selected are then selected to achieve the requisite number of audits.

Targeted selection of audits

- The selection of BERs for targeted audits is completed on an on-going basis.
- Selection of such audits is based on a number of factors (but not limited to) such as complaints, previous audit history and the risk profiling of BER assessments.
- All complaints are recorded in the Contact Relationship Management (CRM) system and each incident has its own reference number, e.g. REF-XXXXX-XXXX.
- BERs selected for audit must be published with a publication status of 'Is Public' and 'Not expired'.
- While sanctions arising from audits should be considered relative to the number of audits received within a 28 day period and the non-compliances detected, more serious offences must be processed in alignment with S.I. No. 243 of 2012, the BER Code of Practice and the BER Quality Assurance System and Disciplinary Procedure.

Monthly allocation sheet

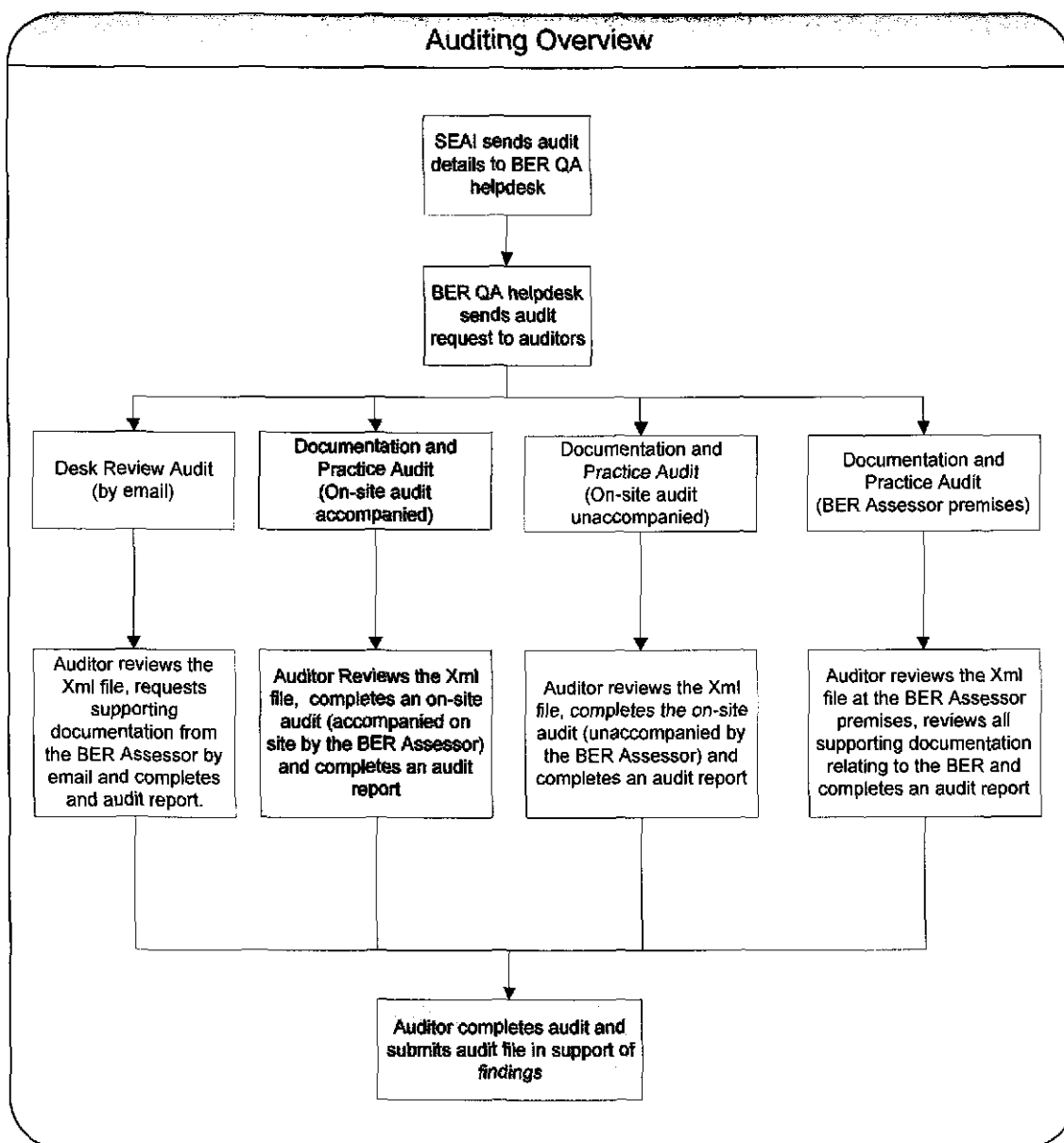
- Each month audits selected on both a random and a target basis are recorded in the audit allocation sheet and saved on the SEAI's SharePoint database.
- All relevant information relating to an audit such as:
 - CRM reference number;
 - BER assessor name;
 - BER Assessor number;
 - Registered email address;
 - BER number;
 - Meter Point Reference Number⁴ (MPRN) number;
 - Date of issue;
 - Building Type;
 - Audit type;
 - Audit item;
 - Audit selection.

⁴ A Meter Point Reference Number (MPRN) is a unique 11 digit number assigned to every single electricity connection and meter in Ireland.

Appendix B: Documentation and Practice audit process

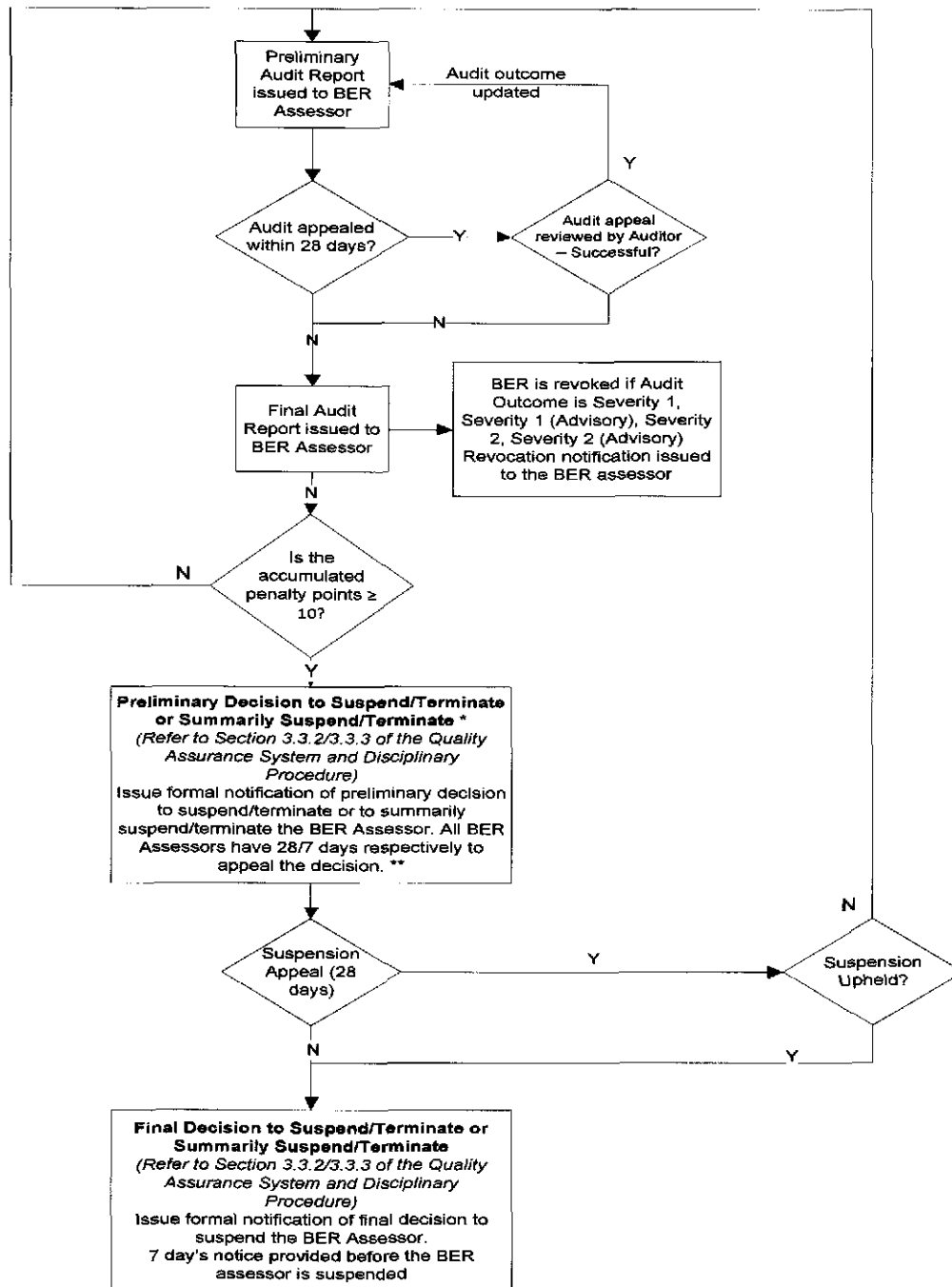
(This audit type is aligned with Option c of EPBD-recast, Annex II, Point 1)

Documentation and Practice Audits (on-site audit) are accompanied by the BER Assessor and are carried out in completing a full check of a BER in relation to a selected building. The audit reviews a BER assessor's compliance with both the relevant BER technical methodologies and the Code of Practice. This audit is selected at random in alignment with the procedures set out in Appendices A and C of this document.



The auditor initially reviews the data file for the BER assessment selected before visiting the building with the BER assessor. At the building address, the BER auditor, accompanied by the BER assessor, will survey the building and review the source data in order to verify substantiation of entries in the data file. Together, the auditor and the BER assessor will review the values entered into the BER data files. The BER auditor records the data on the DEAP survey form (or equivalent). See below.

Any non-compliance detected, is calculated on the basis of published non-compliance classification matrices in determining if the BER is accurate. Audits are processed in accordance with the Quality Assurance System and Disciplinary Procedure. The following is the process flow of the sequence of issuing audit reports.



* Suspension process is automated in CRM Penalty Points System

** Deregistration appeals should be de novo meaning that the assessor should be able to present any matters they wish INCLUDING appeals of individual penalty points assignments even if this option was not earlier exercised.

DEAP Survey form

DEAP for EXISTING HOMES SURVEY FORM																																									
Name: _____ Address: _____ <div style="text-align: right; border: 1px solid black; padding: 2px; width: fit-content; margin-left: auto;">MPRN</div>			Assessor / BER reg. no. _____ Survey Date: _____ Number of occupants <input type="text"/> adults <input type="text"/> children																																						
Dwelling Type <input type="checkbox"/> detached house <input type="checkbox"/> semi detached house <input type="checkbox"/> end of terrace <input type="checkbox"/> mid terrace <input type="checkbox"/> ground floor apartment <input type="checkbox"/> mid floor apartment <input type="checkbox"/> top-floor apartment <input type="checkbox"/> maisonette <i>Pick dwelling type that is closest to actual dwelling type</i>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left; padding: 2px;">Age: known</th> <th style="text-align: left; padding: 2px;">Age: estimated</th> <th style="text-align: left; padding: 2px;">Age: assumed</th> </tr> <tr><td><input type="checkbox"/> pre 1900</td><td><input type="checkbox"/> pre 1900</td><td><input type="checkbox"/> pre 1900</td></tr> <tr><td><input type="checkbox"/> 1900 - 1929</td><td><input type="checkbox"/> 1900 - 1929</td><td><input type="checkbox"/> 1900 - 1929</td></tr> <tr><td><input type="checkbox"/> 1930 - 1949</td><td><input type="checkbox"/> 1930 - 1949</td><td><input type="checkbox"/> 1930 - 1949</td></tr> <tr><td><input type="checkbox"/> 1950 - 1966</td><td><input type="checkbox"/> 1950 - 1966</td><td><input type="checkbox"/> 1950 - 1966</td></tr> <tr><td><input type="checkbox"/> 1967 - 1977</td><td><input type="checkbox"/> 1967 - 1977</td><td><input type="checkbox"/> 1967 - 1977</td></tr> <tr><td><input type="checkbox"/> 1978 - 1982</td><td><input type="checkbox"/> 1978 - 1982</td><td><input type="checkbox"/> 1978 - 1982</td></tr> <tr><td><input type="checkbox"/> 1983 - 1993</td><td><input type="checkbox"/> 1983 - 1993</td><td><input type="checkbox"/> 1983 - 1993</td></tr> <tr><td><input type="checkbox"/> 1994 - 1999</td><td><input type="checkbox"/> 1994 - 1999</td><td><input type="checkbox"/> 1994 - 1999</td></tr> <tr><td><input type="checkbox"/> 2000 - 2004</td><td><input type="checkbox"/> 2000 - 2004</td><td><input type="checkbox"/> 2000 - 2004</td></tr> <tr><td><input type="checkbox"/> 2005 onwards</td><td><input type="checkbox"/> 2005 onwards</td><td><input type="checkbox"/> 2005 onwards</td></tr> <tr><td><input type="checkbox"/> no extension 1</td><td><input type="checkbox"/> no extension 2</td><td></td></tr> </table>		Age: known	Age: estimated	Age: assumed	<input type="checkbox"/> pre 1900	<input type="checkbox"/> pre 1900	<input type="checkbox"/> pre 1900	<input type="checkbox"/> 1900 - 1929	<input type="checkbox"/> 1900 - 1929	<input type="checkbox"/> 1900 - 1929	<input type="checkbox"/> 1930 - 1949	<input type="checkbox"/> 1930 - 1949	<input type="checkbox"/> 1930 - 1949	<input type="checkbox"/> 1950 - 1966	<input type="checkbox"/> 1950 - 1966	<input type="checkbox"/> 1950 - 1966	<input type="checkbox"/> 1967 - 1977	<input type="checkbox"/> 1967 - 1977	<input type="checkbox"/> 1967 - 1977	<input type="checkbox"/> 1978 - 1982	<input type="checkbox"/> 1978 - 1982	<input type="checkbox"/> 1978 - 1982	<input type="checkbox"/> 1983 - 1993	<input type="checkbox"/> 1983 - 1993	<input type="checkbox"/> 1983 - 1993	<input type="checkbox"/> 1994 - 1999	<input type="checkbox"/> 1994 - 1999	<input type="checkbox"/> 1994 - 1999	<input type="checkbox"/> 2000 - 2004	<input type="checkbox"/> 2000 - 2004	<input type="checkbox"/> 2000 - 2004	<input type="checkbox"/> 2005 onwards	<input type="checkbox"/> 2005 onwards	<input type="checkbox"/> 2005 onwards	<input type="checkbox"/> no extension 1	<input type="checkbox"/> no extension 2		<div style="border: 1px solid black; padding: 5px; min-height: 50px;"> number of storeys </div>	
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Wall construction: <u>Walls Type 2</u> <input type="checkbox"/> no wall type 2 <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> stone <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> solid brick <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> cavity <input type="checkbox"/> as built <input type="checkbox"/> bead <input type="checkbox"/> <input type="checkbox"/> solid concrete <input type="checkbox"/> cavity fill <input type="checkbox"/> EPS <input type="checkbox"/> <input type="checkbox"/> hollow block <input type="checkbox"/> external min fibre <input type="checkbox"/> <input type="checkbox"/> timber frame <input type="checkbox"/> internal dense <input type="checkbox"/> <input type="checkbox"/> other <input type="checkbox"/> internal dense <input type="checkbox"/> insulation thickness if observable (mm) <input type="text"/>		Roof construction: <u>Walls Type 2</u> <input type="checkbox"/> no heat loss roof type 2 <input type="checkbox"/> thickness (mm) <input type="text"/> fibre <input type="checkbox"/> <input type="checkbox"/> pitched - insulation btw joists <input type="checkbox"/> thickness (mm) <input type="text"/> fibre <input type="checkbox"/> <input type="checkbox"/> pitched - insulation in rafters <input type="checkbox"/> wamcell <input type="checkbox"/> <input type="checkbox"/> flat - insulation integral <input type="checkbox"/> EPS <input type="checkbox"/> <input type="checkbox"/> room in roof <input type="checkbox"/> unknown <input type="checkbox"/> dense <input type="checkbox"/> <input type="checkbox"/> other <input type="checkbox"/>		Ground Floor Construction: <u>Walls Type 2</u> <input type="checkbox"/> no heat loss extension floor type 2 <input type="checkbox"/> solid <input type="checkbox"/> no heat loss extension floor type 2 <input type="checkbox"/> suspended: sealed <input type="checkbox"/> unsealed <input type="checkbox"/> <input type="checkbox"/> above unheated basement <input type="checkbox"/> other <input type="checkbox"/> Floor Insulation Type of insulation (if any) <input type="checkbox"/> thickness (mm) <input type="text"/> EPS <input type="checkbox"/> (only if any observed) min fibre <input type="checkbox"/> <input type="checkbox"/> none <input type="checkbox"/> unknown <input type="checkbox"/> dense <input type="checkbox"/>																																					
Wall construction: <u>Walls Type 3</u> <input type="checkbox"/> no wall type 3 <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> stone <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> solid brick <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> cavity <input type="checkbox"/> as built <input type="checkbox"/> bead <input type="checkbox"/> <input type="checkbox"/> solid concrete <input type="checkbox"/> cavity fill <input type="checkbox"/> EPS <input type="checkbox"/> <input type="checkbox"/> hollow block <input type="checkbox"/> external min fibre <input type="checkbox"/> <input type="checkbox"/> timber frame <input type="checkbox"/> internal dense <input type="checkbox"/> <input type="checkbox"/> other <input type="checkbox"/> internal dense <input type="checkbox"/> insulation thickness if observable (mm) <input type="text"/>		Roof construction: <u>Walls Type 3</u> <input type="checkbox"/> no heat loss roof type 3 <input type="checkbox"/> thickness (mm) <input type="text"/> fibre <input type="checkbox"/> <input type="checkbox"/> pitched - insulation btw joists <input type="checkbox"/> thickness (mm) <input type="text"/> fibre <input type="checkbox"/> <input type="checkbox"/> pitched - insulation in rafters <input type="checkbox"/> wamcell <input type="checkbox"/> <input type="checkbox"/> flat - insulation integral <input type="checkbox"/> EPS <input type="checkbox"/> <input type="checkbox"/> room in roof <input type="checkbox"/> unknown <input type="checkbox"/> dense <input type="checkbox"/> <input type="checkbox"/> other <input type="checkbox"/>		Ground Floor Construction: <u>Walls Type 3</u> <input type="checkbox"/> no heat loss extension floor type 3 <input type="checkbox"/> solid <input type="checkbox"/> no heat loss extension floor type 3 <input type="checkbox"/> suspended: sealed <input type="checkbox"/> unsealed <input type="checkbox"/> <input type="checkbox"/> above unheated basement <input type="checkbox"/> other <input type="checkbox"/> Floor Insulation Type of insulation (if any) <input type="checkbox"/> thickness (mm) <input type="text"/> EPS <input type="checkbox"/> (only if any observed) min fibre <input type="checkbox"/> <input type="checkbox"/> none <input type="checkbox"/> unknown <input type="checkbox"/> dense <input type="checkbox"/>																																					
Wall construction: <u>Walls Type 4</u> <input type="checkbox"/> no wall type 4 <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> stone <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> solid brick <input type="checkbox"/> wall thickness (mm) <input type="text"/> <input type="checkbox"/> cavity <input type="checkbox"/> as built <input type="checkbox"/> bead <input type="checkbox"/> <input type="checkbox"/> solid concrete <input type="checkbox"/> cavity fill <input type="checkbox"/> EPS <input type="checkbox"/> <input type="checkbox"/> hollow block <input type="checkbox"/> external min fibre <input type="checkbox"/> <input type="checkbox"/> timber frame <input type="checkbox"/> internal dense <input type="checkbox"/> <input type="checkbox"/> other <input type="checkbox"/> internal dense <input type="checkbox"/> insulation thickness if observable (mm) <input type="text"/>		Roof construction: <u>Walls Type 4</u> <input type="checkbox"/> no heat loss roof type 4 <input type="checkbox"/> thickness (mm) <input type="text"/> fibre <input type="checkbox"/> <input type="checkbox"/> pitched - insulation btw joists <input type="checkbox"/> thickness (mm) <input type="text"/> fibre <input type="checkbox"/> <input type="checkbox"/> pitched - insulation in rafters <input type="checkbox"/> wamcell <input type="checkbox"/> <input type="checkbox"/> flat - insulation integral <input type="checkbox"/> EPS <input type="checkbox"/> <input type="checkbox"/> room in roof <input type="checkbox"/> unknown <input type="checkbox"/> dense <input type="checkbox"/> <input type="checkbox"/> other <input type="checkbox"/>		Ground Floor Construction: <u>Walls Type 4</u> <input type="checkbox"/> no heat loss upper floor <input type="checkbox"/> partially heated below <input type="checkbox"/> exposed <input type="checkbox"/> semi exposed <input type="checkbox"/> other <input type="checkbox"/> Floor Insulation Type of insulation (if any) <input type="checkbox"/> thickness (mm) <input type="text"/> EPS <input type="checkbox"/> (only if any observed) min fibre <input type="checkbox"/> <input type="checkbox"/> none <input type="checkbox"/> unknown <input type="checkbox"/> dense <input type="checkbox"/>																																					
<i>*note: Actual U-value may be calculated and used if the wall /roof /floor construction is very different from defaults, and its construction can be determined. Where the thickness of the insulation (if any) can be measured, a U-value may be calculated and used instead of the default if substantiated by evidence.</i>																																									

[illegible]

<input type="checkbox"/> draught lobby on main entrance <input type="checkbox"/> number of sides sheltered <input type="checkbox"/> pressure test results available <input type="checkbox"/> If yes, enter <input style="width: 50px; height: 20px; border: 1px solid black;" type="text"/> adjusted result (ac/h)		<input type="checkbox"/> natural ventilation <input type="checkbox"/> positive input ventilation from loft <input type="checkbox"/> positive input ventilation from outside <input type="checkbox"/> whole house extract ventilation <input type="checkbox"/> balanced whole-house mechanical ventilation without heat recovery <input type="checkbox"/> balanced whole-house mechanical ventilation with heat recovery						
Mechanical ventilation system details if available (e.g. model & number) DEAP manual contains guidance on using non default SFP and efficiency for mechanical ventilation units.								
Space heating system (general information)								
Primary Heating System <input type="checkbox"/> radiator system <input type="checkbox"/> storage heaters <input type="checkbox"/> underfloor <input type="checkbox"/> warm air <input type="checkbox"/> room heaters only <input type="checkbox"/> community <input type="checkbox"/> other:		Secondary Heating System <input type="checkbox"/> no secondary system <input type="checkbox"/> radiator system <input type="checkbox"/> storage heaters <input type="checkbox"/> underfloor <input type="checkbox"/> warm air <input type="checkbox"/> room heaters only <input type="checkbox"/> other:						
Gas / Oil / LPG boilers <input type="checkbox"/> primary <input type="checkbox"/> secondary <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; vertical-align: top;"> Boiler type <input type="checkbox"/> standard <input type="checkbox"/> combi <input type="checkbox"/> condensing <input type="checkbox"/> back boiler <input type="checkbox"/> CPSU <input type="checkbox"/> range cooker <input type="checkbox"/> single burner <input type="checkbox"/> twin burner </td> <td style="width: 33%; vertical-align: top;"> Flue type <input type="checkbox"/> open <input type="checkbox"/> balanced <input type="checkbox"/> fan assisted Mounting <input type="checkbox"/> wall <input type="checkbox"/> floor </td> <td style="width: 33%; vertical-align: top;"> Age <input type="checkbox"/> 1998 or later <input type="checkbox"/> pre 1998 <input type="checkbox"/> oil: pre 1985 <input type="checkbox"/> gas / LPG pre 1979 ignition <input type="checkbox"/> auto <input type="checkbox"/> permanent pilot </td> </tr> </table> Manufacturer / make / model number		Boiler type <input type="checkbox"/> standard <input type="checkbox"/> combi <input type="checkbox"/> condensing <input type="checkbox"/> back boiler <input type="checkbox"/> CPSU <input type="checkbox"/> range cooker <input type="checkbox"/> single burner <input type="checkbox"/> twin burner	Flue type <input type="checkbox"/> open <input type="checkbox"/> balanced <input type="checkbox"/> fan assisted Mounting <input type="checkbox"/> wall <input type="checkbox"/> floor	Age <input type="checkbox"/> 1998 or later <input type="checkbox"/> pre 1998 <input type="checkbox"/> oil: pre 1985 <input type="checkbox"/> gas / LPG pre 1979 ignition <input type="checkbox"/> auto <input type="checkbox"/> permanent pilot	Solid Fuel Boilers <input type="checkbox"/> primary <input type="checkbox"/> secondary <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> open fire + back boiler <input type="checkbox"/> closed room heater + back boiler <input type="checkbox"/> grate: rectangular <input type="checkbox"/> trapezium <input type="checkbox"/> manual feed boiler <input type="checkbox"/> auto feed boiler MF / AF boiler in heated space? <input type="checkbox"/> </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> housecoal <input type="checkbox"/> anthracite <input type="checkbox"/> smokeless <input type="checkbox"/> peat briquettes <input type="checkbox"/> sod peat <input type="checkbox"/> wood pellets <input type="checkbox"/> wood chips <input type="checkbox"/> biomass </td> </tr> </table> Manufacturer / make / model number		<input type="checkbox"/> open fire + back boiler <input type="checkbox"/> closed room heater + back boiler <input type="checkbox"/> grate: rectangular <input type="checkbox"/> trapezium <input type="checkbox"/> manual feed boiler <input type="checkbox"/> auto feed boiler MF / AF boiler in heated space? <input type="checkbox"/>	<input type="checkbox"/> housecoal <input type="checkbox"/> anthracite <input type="checkbox"/> smokeless <input type="checkbox"/> peat briquettes <input type="checkbox"/> sod peat <input type="checkbox"/> wood pellets <input type="checkbox"/> wood chips <input type="checkbox"/> biomass
Boiler type <input type="checkbox"/> standard <input type="checkbox"/> combi <input type="checkbox"/> condensing <input type="checkbox"/> back boiler <input type="checkbox"/> CPSU <input type="checkbox"/> range cooker <input type="checkbox"/> single burner <input type="checkbox"/> twin burner	Flue type <input type="checkbox"/> open <input type="checkbox"/> balanced <input type="checkbox"/> fan assisted Mounting <input type="checkbox"/> wall <input type="checkbox"/> floor	Age <input type="checkbox"/> 1998 or later <input type="checkbox"/> pre 1998 <input type="checkbox"/> oil: pre 1985 <input type="checkbox"/> gas / LPG pre 1979 ignition <input type="checkbox"/> auto <input type="checkbox"/> permanent pilot						
<input type="checkbox"/> open fire + back boiler <input type="checkbox"/> closed room heater + back boiler <input type="checkbox"/> grate: rectangular <input type="checkbox"/> trapezium <input type="checkbox"/> manual feed boiler <input type="checkbox"/> auto feed boiler MF / AF boiler in heated space? <input type="checkbox"/>	<input type="checkbox"/> housecoal <input type="checkbox"/> anthracite <input type="checkbox"/> smokeless <input type="checkbox"/> peat briquettes <input type="checkbox"/> sod peat <input type="checkbox"/> wood pellets <input type="checkbox"/> wood chips <input type="checkbox"/> biomass							
Electric Storage Heaters <input type="checkbox"/> primary <input type="checkbox"/> secondary <input type="checkbox"/> modern / slimline <input type="checkbox"/> convector <input type="checkbox"/> integrated storage / direct acting (inc. room stat) Control options <input type="checkbox"/> manual charge control <input type="checkbox"/> automatic / weather dependent <input type="checkbox"/> Collect-type		Gas Room Heaters <input type="checkbox"/> primary <input type="checkbox"/> secondary <input type="checkbox"/> pre 1980 <input type="checkbox"/> coal effect - sealed flue <input type="checkbox"/> coal effect - open to chimney <input type="checkbox"/> flueless <input type="checkbox"/> condensing <input type="checkbox"/> back boiler (no rads) <input type="checkbox"/> other (none of above) Front <input type="checkbox"/> open-fronted <input type="checkbox"/> glass-fronted Flue type <input type="checkbox"/> open <input type="checkbox"/> balanced <input type="checkbox"/> fan assisted						
Warm Air Systems <input type="checkbox"/> primary <input type="checkbox"/> secondary <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> Ducted or Stub Ducted <input type="checkbox"/> on - off <input type="checkbox"/> modulating Age <input type="checkbox"/> 1998 or later <input type="checkbox"/> pre 1998 </td> <td style="width: 50%; vertical-align: top;"> Other Features (tick all that apply) <input type="checkbox"/> fan assisted <input type="checkbox"/> condensing <input type="checkbox"/> with flue heat recovery Other types <input type="checkbox"/> Room heater with in floor ducts <input type="checkbox"/> Electric electricaire </td> </tr> </table>		Ducted or Stub Ducted <input type="checkbox"/> on - off <input type="checkbox"/> modulating Age <input type="checkbox"/> 1998 or later <input type="checkbox"/> pre 1998	Other Features (tick all that apply) <input type="checkbox"/> fan assisted <input type="checkbox"/> condensing <input type="checkbox"/> with flue heat recovery Other types <input type="checkbox"/> Room heater with in floor ducts <input type="checkbox"/> Electric electricaire	Room Heaters <input type="checkbox"/> primary <input type="checkbox"/> secondary <input type="checkbox"/> room heater / range <input type="checkbox"/> room heater / range with boiler (no rads) Age <input type="checkbox"/> pre 2000 <input type="checkbox"/> 2000 or later				
Ducted or Stub Ducted <input type="checkbox"/> on - off <input type="checkbox"/> modulating Age <input type="checkbox"/> 1998 or later <input type="checkbox"/> pre 1998	Other Features (tick all that apply) <input type="checkbox"/> fan assisted <input type="checkbox"/> condensing <input type="checkbox"/> with flue heat recovery Other types <input type="checkbox"/> Room heater with in floor ducts <input type="checkbox"/> Electric electricaire							
Heat Pumps <input type="checkbox"/> primary <input type="checkbox"/> secondary <input type="checkbox"/> air-to-air <input type="checkbox"/> ground-to-air <input type="checkbox"/> water-to-air <input type="checkbox"/> air-to-water <input type="checkbox"/> ground-to-water <input type="checkbox"/> water-to-water <input type="checkbox"/> gas-fired - ground / water <input type="checkbox"/> gas-fired, air source heat pump includes auxiliary electric heater <input type="checkbox"/> Manufacturer / make / model number		Solid Fuel Room Heaters <input type="checkbox"/> primary <input type="checkbox"/> secondary <input type="checkbox"/> open fire in grate <input type="checkbox"/> open fire with backboiler (no rads) <input type="checkbox"/> closed room heater <input type="checkbox"/> closed room heater with backboiler (no rads) Manufacturer / make / model number						
Electric Room Heaters <input type="checkbox"/> primary <input type="checkbox"/> secondary <input type="checkbox"/> panel, convector, or radiant heater <input type="checkbox"/> fan heater		(Empty space for additional notes or details)						

Heating system (Domestic Hot Water)			
<input type="checkbox"/> from primary heating system <input type="checkbox"/> electric immersion <input type="checkbox"/> electric instantaneous If instantaneous combi boiler: If storage combi: store volume	<input type="checkbox"/> gas instant: single point <input type="checkbox"/> gas instant: multi point <input type="checkbox"/> gas circulator pre 1998 <input type="checkbox"/> keep hot facility controlled by <input type="checkbox"/> <55 litres <input type="checkbox"/> >= 55 litres	<input type="checkbox"/> backboiler / kitchen range <input type="checkbox"/> gas <input type="checkbox"/> oil <input type="checkbox"/> SF <input type="checkbox"/> gas circulator 1998 or later <input type="checkbox"/> timeclock <input type="checkbox"/> no timeclock	<input type="checkbox"/> none <input type="checkbox"/> solar water heating system present <input type="checkbox"/> evacuated tube <input type="checkbox"/> flat plate, glazed overshadowing: <input type="checkbox"/> very little (<20%) <input type="checkbox"/> modest (20-60%) <input type="checkbox"/> significant (61-80%) <input type="checkbox"/> heavy (>80%)
<input type="checkbox"/> no access <input type="checkbox"/> capacity (litres) <input type="checkbox"/> or dimensions	Insulation: <input type="checkbox"/> no insulation <input type="checkbox"/> lagging jacket <input type="checkbox"/> factory fitted	<input type="checkbox"/> primary pipework insulated <input type="checkbox"/> insulation <input type="checkbox"/> thickness (mm)	Controls: <input type="checkbox"/> cylinder thermostat <input type="checkbox"/> independent timer
<input type="checkbox"/> not applicable <i>*only if space heating and water heating cannot be separated. See DEAP manual</i> <input type="checkbox"/> electric heater present for supplementary hot water heating*			gross solar panel area (m ²) dedicated solar storage volume (litres) contained within combined cylinder contained within separate cylinder orientation tilt ° Solar panel make and model:
Heating system (Controls)			
<input type="checkbox"/> no controls <input type="checkbox"/> programmer / timeclock <input type="checkbox"/> room thermostat number <input type="checkbox"/> TRV's % rads with TRVs <input type="checkbox"/> bypass <input type="checkbox"/> load compensator <input type="checkbox"/> weather compensator <input type="checkbox"/> full zone control <input type="checkbox"/> boiler energy management system <input type="checkbox"/> delay start thermostat <input type="checkbox"/> boiler interlock <input type="checkbox"/> appliance thermostat <input type="checkbox"/> appliance timeclock	<input type="checkbox"/> in insulated timber floor <input type="checkbox"/> in screed <input type="checkbox"/> in concrete	<input type="checkbox"/> whole house UFH <input type="checkbox"/> Partial UFH including living area <input type="checkbox"/> Partial UFH not including living area	<input type="checkbox"/> central heating pump <input type="checkbox"/> indoor oil supply pump <input type="checkbox"/> outdoor oil supply pump <input type="checkbox"/> gas boiler flue fan
Group Heating			
<input type="checkbox"/> pre 1991 full flow mid-high temp: not pre-insulated <input type="checkbox"/> pre 1991 full flow low temp: pre-insulated <input type="checkbox"/> 1991 or later variable flow mid temp: pre-insulated <input type="checkbox"/> 1991 or later variable flow low temp: pre-insulated consumption charged: flat rate linked to use	<input type="checkbox"/> efficiency % <input type="checkbox"/> proportion of group heating % <u>Fuel type of heating system</u> <u>Make and model of heating system</u>	<input type="checkbox"/> efficiency % <input type="checkbox"/> proportion of group heating % <u>Fuel type of heating system</u> <u>Make and model of heating system</u>	<input type="checkbox"/> % heat from CHP (or power station) <input type="checkbox"/> power station <input type="checkbox"/> CHP <u>CHP efficiencies</u> <input type="checkbox"/> Electrical % <input type="checkbox"/> Thermal % <input type="checkbox"/> Fuel

Appendix C: Statistical significance sample size calculation

An appropriate number (sample) of BER ratings (population) per year are audited to determine if the process (the publication of ratings by BER assessors) is capable of consistently publishing ratings which accurately⁵ reflect the energy performance of a building.

Data can be described in two broad types, *Continuous* and *Categorical*.

Continuous data relates to quantitative data, e.g. 4m², 5kWh/m²/year, 0.27W/m²/yr etc. Basically any data that can be measured is described as continuous data.

Categorical data, in contrast, is for those aspects of data where a distinction can be made between different groups, and where a small number of categories can typically be listed. This data includes yes/no, pass/fail, building type, age band etc.

For the purpose of determining if the process (the publication of ratings by BER assessors) is capable of consistently publishing ratings which accurately⁶ reflect the energy performance of a building, Pass/Fail categorical data best describes the data study.

An appropriate sample size for Categorical data is calculated as follows:

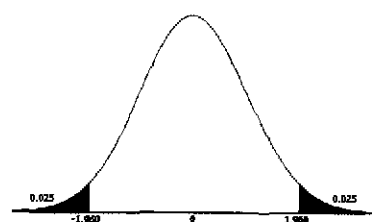
$$n_o = \frac{(t)^2 \times (p)(q)}{(d)^2}$$

Where:

n_o is the minimum sample size

t is the **t-value**; selected based on the level of risk accepted in the sample or how sure you can be. The level of risk or *alpha level* used in determining sample size is typically either .05 or .01. In general, an alpha level of .05 is acceptable for most research. An alpha level of .10 or lower may be used if the researcher is more interested in identifying marginal relationships, differences or other statistical phenomena as a precursor to further studies. An alpha level of .01 may be used in those cases where decisions based on the research are critical and errors may cause substantial financial or personal harm, e.g. major programmatic changes.

t-value for alpha level of .05 (0.025 in each tail) is **1.96** for sample sizes above 120



pq or (p (1-p)) is the estimate of variance

where:

⁵ The audit outcome demonstrates that the rating is either compliant or warrants a Severity 3 finding (i.e. a minor non-compliance).

⁶ The audit outcome demonstrates that the rating is either compliant or warrants a Severity 3 finding (i.e. a minor non-compliance).

p is the maximum possible proportion and
q is (1 – maximum possible proportion) or (1-p)

When estimating variance, it is recommended that a value of **0.5** is selected which results in the maximum variance which will also produce the maximum sample size.

This means that, as the outcome is unknown, it is presumed that 50% of ratings will pass (Compliance or Severity 3 audit outcome) and 50% of ratings will fail (Severity 1 or Severity 2 audit outcome).

d is the margin of error or confidence interval e.g. 5 is +/- 5% or 3 is +/-3%

For categorical data, 5% margin of error is typically acceptable, and, for continuous data, 3% margin of error is typically acceptable.

Using the above selected variables and parameters the minimum sample size for BER is therefore calculated as follows:

$$n_o = \frac{(1.96)^2 \times (0.5)(1 - 0.5)}{(0.05)^2}$$

$$n_o = 384$$

Note in instances where the new sample size exceeds 5% of the total population an adjustment factor is applied.

With the BER population being c. 75,000 in one year, the minimum samples size ($n_o = 384$) is below 5% of the population (3,750), then no adjustment is necessary.

Conclusion on the basis of a population of 75,000 ratings if we undertake an audit of a totally random sample of 384 ratings, then this will be a statistically significant sample from which we will be able to derive the compliance level of BERs with a confidence level of 95% and a margin of error on the result of +/- 5%.