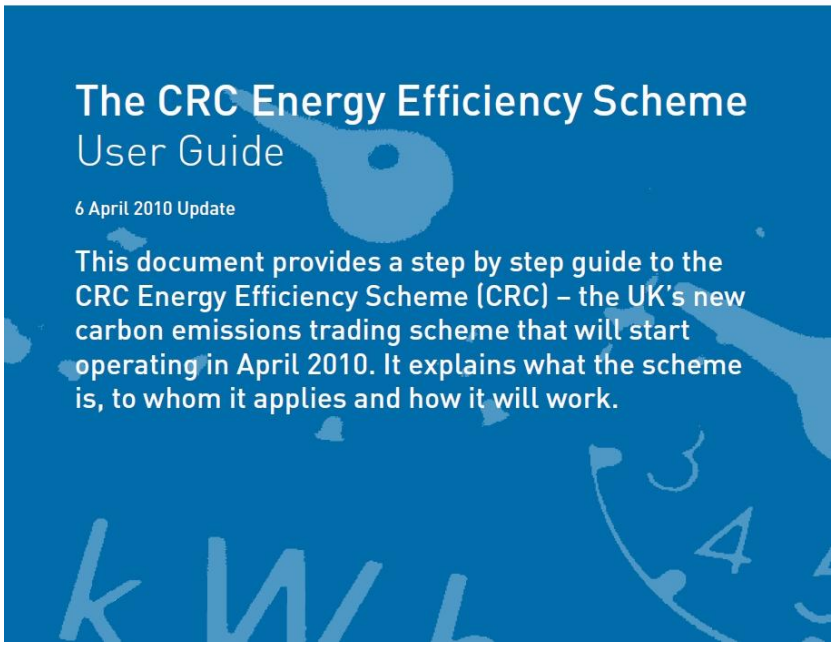
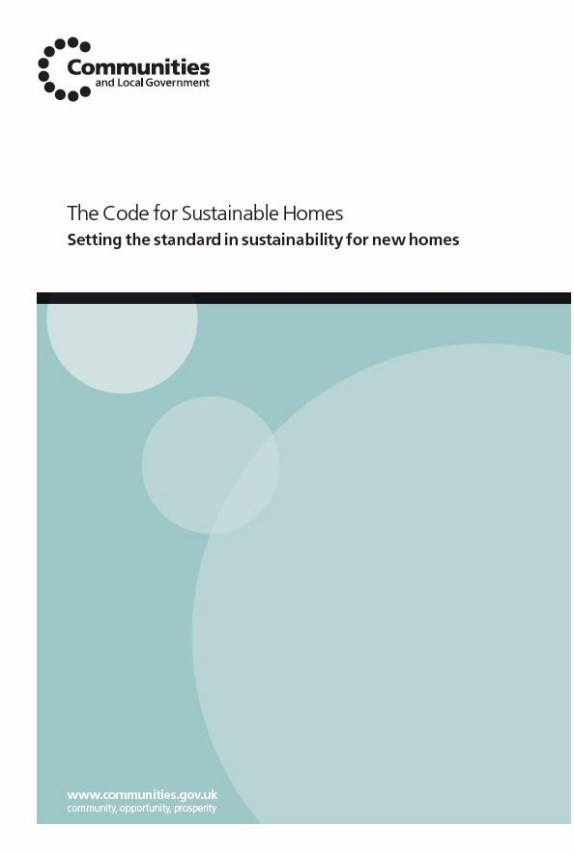
NBS-M009 - 2010





LOW CARBON BUSINESS REGULATION AND ENTREPRENEURSHIP

An electronic version of this handout may be accessed at

http://www2.env.uea.ac.uk/gmmc/energy/nbs-m009/nbs-m009.htm

NBS-M009 - 2010

LOW CARBON BUSINESS REGULATION AND ENTREPRENEURSHIP

1. Carbon Reduction Commitment – Energy Efficiency Scheme

1.1 Background and Qualification

1.2 How CRC will work

1.3 Registration for CRC and a summary of exemptions

1.4 Phases of CRC

1.5. Technical Details of CRC

1.6 The CRC League Table and how performance is assessed.

1.7 Example of financial benefit/penalty to different companies.

1.8 Example of different metrics

2. Building Regulations

2.1 Development of UK Building Regulations

2.2 Code for Sustainable Homes

2.3 Non Domestic Buildings

2.4 Indian Building Regulations

2.5 Chinese Building Regulations

The following sections will be in separate Handouts

3. Electricity Regulation

3.1 Electricity Markets Supply and Demand – Technical Issues

3.2 Electricity Markets: Electricity Pool and Deregulation

3.3 Electricity Markets: NETA and BETTA

4. UK Regulation to promote Renewable Generation

4.1Non Fossil Fuel Obligation

4.2Renewable Obligation

4.3Marine Supply Obligation (Scotland)

4.4 Renewable Transport Fuel Obligation

4.5 Heat Obligation?

4.6 An Integrated Obligation?

UEA Energy Home Page: http://www2.env.uea.ac.uk/gmmc/env/energy.htm
Energy Links: http://www2.env.uea.ac.uk/gmmc/energy/enpoint.htm

CONTENTS

Page

1. Carbon Reduction Commitment 3

1.1 Background and Qualification 3
1.2 How CRC will work 4
1.3 Registration for CRC and a summary of exemptions 4
1.4 Phases of CRC 6
1.5. Technical Details of CRC 6
1.6 The CRC League Table and how performance is assessed. 7
1.7 Example of financial benefit/penalty to different companies. 8
1.8 Example of Different Metrics 9
1.9 Useful Links 9

2. Building Regulations 10

2.1 Development of UK Building Regulations
2.1.1 Summary 10
2.1.2. Deficiencies in Earlier Building Regulations. 10
2.1.3. Effect of Construction Type (Built Form) on Energy Consumption 11
2.1.4 The 1994 Regulations – the first significant step. 12
2.1.4.1 Introduction 12
2.1.4.2 Developments of the 1994 Regulations 12
2.1.4.3 Compliance Requirements of the 1994 Regulations 13
2.1.5 Building Regulations 2000 (implemented 1st April 2002). 13
2.1.5.1 Introduction 13
2.1.5.2 Main Differences of 2000 Regulations 13
2.1.5.3 Compliance Requirements. 14
The Elemental Approach 14
The Target U-Value Approach 14
The Carbon Index Method 14
2.1.6 The 2005 Building Regulations 15
2.1.6.1 Technical Changes 15
2.1.6.2. Compliance 15
2.1.7 A critique of the Standard Assessment Procedure SAP (1994) 16
2.1.8 The Standard Assessment Procedure – 1994 and 2001. 17
2.1.9 SAP Rating for 2005 Regulations. 17
2.1.10 The Carbon Index Calculations (for 2000 Regulations). 18
2.1.11 The Dwelling Emission Rate (DER) 19
2.1.12 New Building Regulations 20

2.2 Code for Sustainable Homes 19
2.3. Non Domestic Buildings 24
2.4. Indian Building Regulations 25
2.5 Chinese Building Regulations 26

Appendix A1: Special rules for organisations under the Climate Reduction commitment. 28
Appendix A2: CRC Arrangements for those sites which generate and export electricity 32
Appendix A3: CRC Arrangements for those sites which generate and export electricity. 33

Appendix A4: CRC – Energy Efficiency Scheme: Exclusions 34

1. CARBON REDUCTION COMMITMENT – ENERGY EFFICIENCY SCHEME

1.1 Background and Summary of Scheme

The Carbon Reduction Commitment (CRC), as it was originally known, is an emissions trading scheme which will be mandatory for the affected organizations and will be applicable to the UK as part of its objective to achieve a reduction in green house gas emissions by 80% by 2050. Following consultation the name was changed in late 2009 to Carbon Reduction Commitment – Energy Efficiency Scheme or CRC – EES.

The affected organizations will generally be large and in both the public and private sectors. The primary criterion as to whether an organization will be affected will be based on its electricity consumption in 2008. However, those organizations affected by other schemes such as the EU-ETS will have their commitment to CRC reduced.

All organizations affected will have to purchase allowances for emissions, but will then get a rebate depending on how well they have performed compared to other organizations. Thus an organization which is moving more proactively towards carbon reduction will gain financially whereas an organization which is not will suffer.

It is estimated that around 20 000 organizations will be affected. A lengthy process of consultation was conducted between 2007 and 2009 and the details of the consultation and how Government thinking changed may be seen at:
http://www.decc.gov.uk/en/content/cms/consultations/crc/crc.aspx

The following link gives information on the current situation together with a number of late changes just prior to implementation in April 2010.
http://www.environment-agency.gov.uk/business/topics/pollution/98263.aspx

As part of the CRC-EES, all participants must monitor and record their CO_2 emissions. Of the 20 000 organisations, it is expected that 5000 will be required to participate fully and purchase allowances, whereas under the present state of development, the remainder will be required to make an *information disclosure* on their emissions once every few years. There will be financial penalties for any affected organization which refuses to comply with the requirements of the legislation.

The CRC-EES will start in April 2010 and will be divided into an introductory phase (also known as phase 1) which will run for three years, and subsequent phases each 7 years long in which the first two years are preparatory and overlap with the previous phase.

Within each phase there will essentially be (taken from the Draft Legislation Document):

- A ***qualification period,*** where organisations must assess whether or not they qualify to make an information disclosure or participate fully in CRC-EES
- A ***registration period***, where organisations must either submit their information disclosure or register as a participant with the administrator
- A ***footprint year***, where participants must monitor their total emissions from energy use. Note some emissions are excluded such as those already covered by EU-ETS.
- A series of ***compliance years***, which run from April to March, during which participating organisations must purchase allowances for each tonne of CO_2 they emit, based on expected energy use, and monitor their usage.

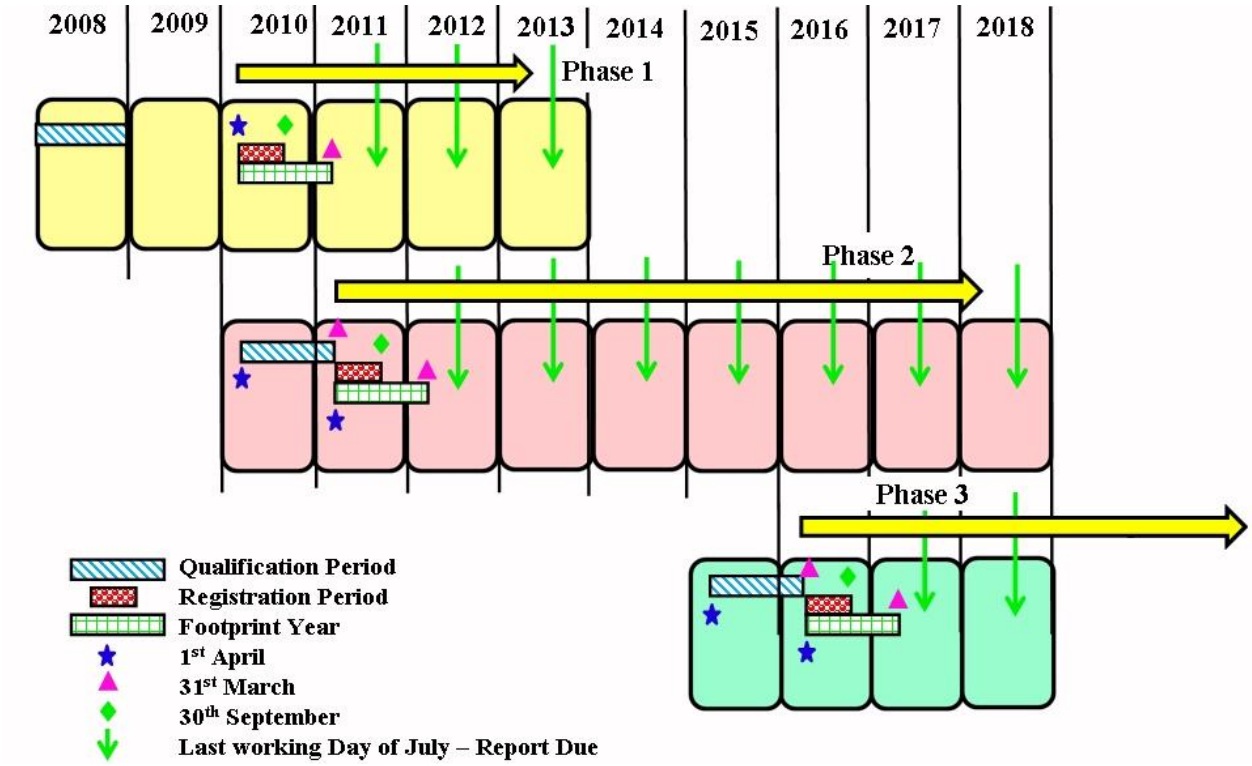


Fig.1.1 Timeline for CRC –Energy Efficiency Scheme showing different phases which overlap. Financial Obligations arise on Participants from April 2011 (Phase 1), April 2013 (Phase 2), and April 2018 (Phase 3) – see Fig. 1.2.

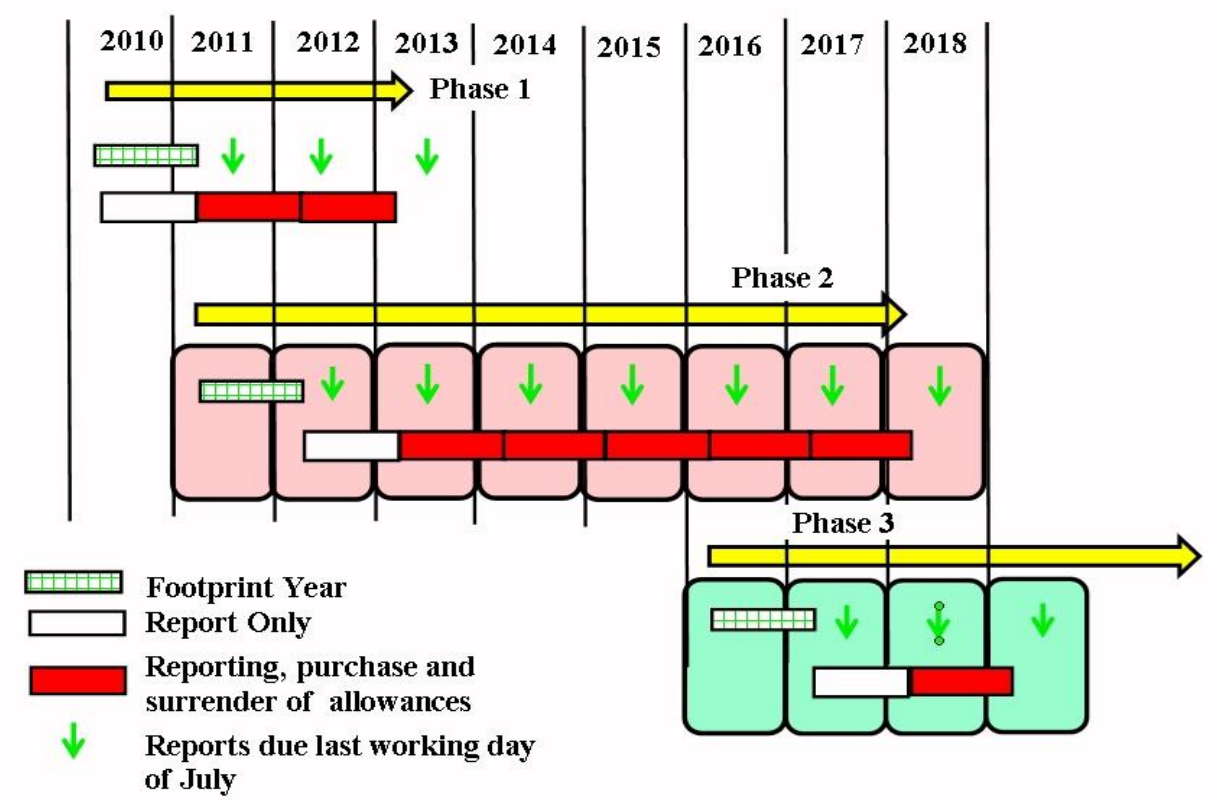


Fig. 1.2 Timeline for Reporting for Compliance Years

Affected organizations must report their emissions in July each year from the 12 months ending on the preceding 31st March. At the same time they must surrender allowances covering these emissions. In October there they will receive their recycling payments based on their performance compared to other organizations.

There are some special arrangement for the Introductory Phase and these are covered in Section 1.4.

During the Introductory Phase the allowances will have a a fixed price of £12 per tonne of CO_2. This figure should not be confused with the minimum safety valve price which was also originally set at £12 but this figure was increased to £14 per tone of CO_2 in late February 2010 just before CRC-EES started on 1st April 2010. (see section 1.5 for more details).

Following the initial sale period, participants can purchase or sell allowances via trading on a ***secondary market***. The details of how this will work are covered in the next section.

1.2 How CRC-EES will work

A critical issue as to whether an organization will be required to be involved depends on its electricity consumption (initially in the introductory phase of the calendar year 2008). An organization must be a full participant if the following conditions apply:

i). They have at least one half hour meter (HHM) for which they pay on a half hour tariff.
ii). The annual electricity consumption exceeds 6000 MWh. This would be equivalent to the average consumption of 1500 homes.

If an organization satisfies criterion (1) but not (ii) they do not have to participate fully but have to make disclosures of their emissions. In subsequent phases it is likely that this threshold value of 6000 MWh per annum will be reduced and it will be important that organizations which fall just below the criteria are aware as they may well be involved in such a scheme in future Phases and could be at a disadvantage as they would be late entrants.

There are issues in some cases as to who is responsible e.g in a landlord tenant situation. In general it will be the organization who pays the bill directly to the electricity supplier (this may mean that tenants may or may not be responsible). Further details as to what counts as an organization may be found in Appendix A1.

There are also issues surrounding what counts as an organization when there are subsidiaries etc. There could be a case where a company deliberately demerged to try to avoid being involved. As a result there are quite proscriptive rules as to what constitutes an organization. The energy consumption across the **whole organisation** must be taken into account. If the organization is any of the following, specific rules apply:

- part of an organizational group, (e.g. a subsidiary)
- a GB central Government department or related body or agency
- a joint venture
- a franchisee or franchisor
- a school or local authority
- a university.

The specific rules are laid out in Appendix A1.

1.3 Registration for CRC-EES and a summary of exemptions

If an organization satisfies the criteria for participation it must register for the Introductory Phase between 1st April 2010 and 30th September 2010. There will be registration fees and annual participation fees for the organizations concerned. These fees

will cover the administration of the scheme so that all income obtained from the purchase of allowances will be recycled.

Exemptions:

This section summarises the key areas which are exempt from the CRC-EES. Full details may be found in Section 6 (Appendix 4) of the USER Guide.

http://www.environment-agency.gov.uk/business/topics/pollution/98263.aspx

The key exemptions are:

1. domestic accommodation,
2. transport

and

3. energy supplied to a Third Party.

Domestic Accommodation Exemptions:

Energy used for domestic accommodation is exempt from the CRC-EES scheme unless it is provided for:

- Education
- Employment
- Religion
- Recreation
- Medical Care

In mixed use buildings – e.g. accommodation within a building with other uses, only the accommodation energy use is exempt from CRC.

Transport Exemptions

For some organizations such as transport undertakings which use the majority of their electricity for transport, they may be exempt even if their total consumption satisfies the qualification criteria. Essentially any electricity used solely for motive power can be deducted and if this lowers the total consumption to less than 1000 MWh per annum then an exemption for the duration of the phase applies. Further details may be found in Appendix 4 of the User Guide.

Climate Change Agreements

If an organization has at least 25% of its energy use covered by a Climate change Agreement in any one accounting period then that organization is exempt from CRC-EES during that period.

The same will apply to a subsidiary if 25% of its energy use is covered by a CCA then the whole of the energy use of that subsidiary is exempt.

Other exemptions

Any emissions covered by a CCA not included above or EU-ETS should be deducted before calculation of the net emissions from an organization.

Emissions arising from energy supplied by an organization are also deducted from the total emissions. However, there are special arrangements relating to electricity generation on site and the arrangements depend on the fuel type. These arrangements are covered in Appendix A2.

It is not necessary to include every single emissions from every small source provided that at least 90% of emissions of the organization have been included. A summary of the procedure required to estimate relevant emissions is shown in Figure 1.3 which is taken from page 33 of the User Guide..

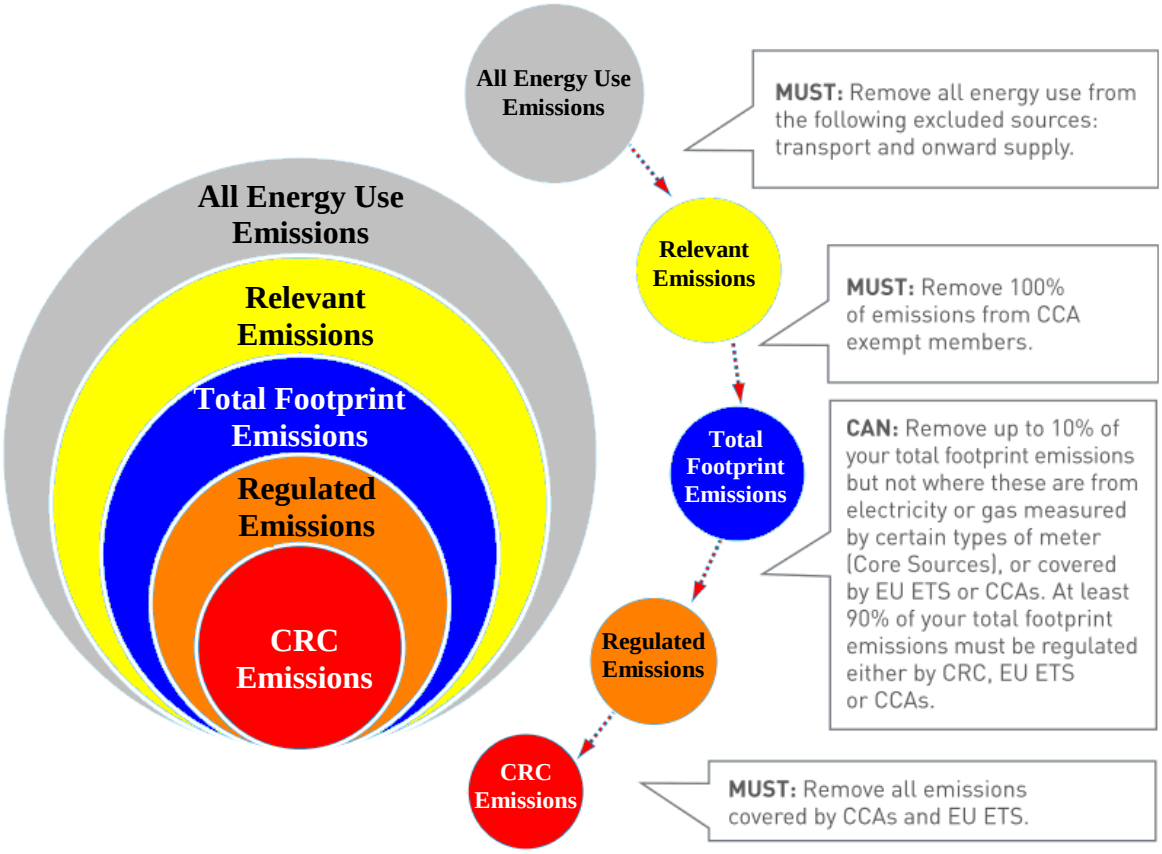


Figure 1.3 Steps taken to decide the relevant emissions under CRC-EES

There is a standard procedure for calculating emissions based on metered electricity and gas consumption and deliveries of other fuels such as oil, LPG etc. The procedure uses defined carbon emission factors.

The documentary evidence will be provided in the form of bills, but where any invoices are estimates, the associated energy consumption is automatically inflated by 10% (this is a mandatory requirement).

1.4 Phases of the CRC-EES

Introductory Phase

There are some special arrangement which will apply only to the ***Introductory Phase*** based on the timing of the various periods defined above:

- the ***qualification period*** is the calendar year 2008
- the ***registration period*** is April-September 2010
- the ***footprint year*** is April 2010-March 2011, and
- the ***first compliance year*** is also April 2010-March 2011. This is a key aspect where the Introductory Phase differs from subsequent phases i.e the footprint year and first compliance year are identical. This means that special arrangements for the purchase of allowances are also needed..
- There will be a fixed price of £12 per tonne for the allowances purchased.

Second Phase

The second phase will start in April 2011 (see Fig. 1.1) although trading in this phase will not start until April 2013. The phase will run until March 31st 2018. A key difference in this and subsequent phases is that the total emissions will be capped. Details are covered in section 5 of the User Guide. Though many things will be the same as during the first phase, there are some important differences.

i). During the first phase, unlimited numbers of allowances will be issued, but in the subsequent phases there will be a cap on the total number of allowances available subject to no one participant being allowed to purchase more than a given percentage of the total allowances available.

ii). Unlike the first phase there will be no overlap between the footprint and first compliance years. The footprint year will be the last year of Phase 1 i.e. April 2012 – March 2013.

iii). Unlike the first phase, the allowances will not be sold at a fixed price. Instead a capping will be introduced combined with an auction as indicated below from the User Guide.

- ***"Participants will be asked to submit a 'bid schedule' that sets out the number of allowances they would wish to buy at different prices. For example, an organisation might want to buy 1,500 allowances if the price were to be £10/allowance, but 1,000 at £15/allowance, recognising that the relative cost effectiveness of energy efficiency technologies change with increasing allowance prices.***

- ***Government will add all the bids from participants together to determine the price where demand for allowances from participants meets the number of allowances for sale from Government – 'the clearing price'.***

- ***Participants will then be allocated the number of allowances they bid for, at the clearing price and will pay that price for them – i.e. irrespective of what price they bid as long as the bid price was above the 'clearing price'***

"***As allowances are auctioned and supply of allowances is capped, the price of allowances will be dependent on demand each year***."

iii). There will be a change in the way the metrics used to assess performance are weighted. The issue of assessment metrics is covered in the next section.

1.5. Technical Details of CRC-EES

Sale of allowances

In the first year of compliance there will be no sale of allowances as the first compliance year is also the footprint year. As a result the first sale of allowances will take place in April 2011, when organisations will purchase allowances to cover projected CRC-EES emissions in the financial year 2011/12.

Organizations will thus have to budget for this. At the end of July 2011, they will have to report on their footprint year and depending on their relative performance compared to other organizations in the three assessment metrics (see below), they may get back more or less than they purchased in October 2011.

In subsequent years a similar procedure will apply – I,e, purchasing allowances for the coming year and reporting on performance in the preceding year, this latter will form the basis of how beneficial or otherwise their recycled payments will be.

Purchasing Extra allowances

After the initial sale, it will be possible to purchase additional allowances if the organisation's emissions are higher than anticipated. There are two ways of doing this:

- trading with other CRC-EES participants in the secondary market
- buying allowances through the safety valve mechanism.

Revenue from sales on the secondary market and through the safety valve will not be included as part of the pot of money that will be recycled.

Buying allowances on the secondary market

The secondary market includes all CRC-EES participants and traders, organisations and individuals that aren't participants in CRC-EES but who are registered with CRC-EES. Sales will take place by mutual agreement between the seller and buyer with no independent control of the price. Such secondary market participants might be brokers who will deal specificallty in such trades.

Buying allowances through the safety valve

There is a danger that if left solely to the secondary market, unrealistically high (or low) prices may occur resulting in significant price volatility (as happened in EU-ETS – phase 1). CRC-EES has built in a safety valve whereby participants can

ask the administrator to issue extra allowances throughout the year by the following mechanism.

- When allowances are purchased through the safety valve mechanism the participant will initially be asked to pay a deposit based on the relevant safety valve price in the previous month.
- The government will then make purchases of allowances from the EU-ETS and adjusts the payment price (i.e. extra required or a refund) accordingly.
- The government will then cancel the relevant number of EU-ETS allowances to ensure the integrity of both trading systems. However, the Government will not sell any safety valve allowances if the EU-ETS price falls below a floor price (which was initially set at the initial allocation price (i.e £12 in the initial phase). However, in February 2010 just before the start of CRC-EES this figure was raised to £14. This means that any purchases through the safety valve mechanism will always be greater than the initial fixed price.
- Each time a participant in CRC requests that allowances are purchased through the safety valve mechanism and fixed charge of £300 will be made on top of the transactions indicated above.

Selling and Banking Allowances

If an organization finds it has surplus allowances it may sell these on the secondary market either directly to another CRC-EES participant or to a trader. On the other hand it can bank the allowances for use in future use with the exception it is not possible to carry forward banked allowances from the initial phase fixed price phase to the capped second phase.

In CRC-EES, organizations will not be able to borrow allowances from future years.

1.6 The CRC-EES League Table and how performance is assessed.

Each participating organization purchases allowances for each year and then received a rebate the magnitude of which depends on their relative position in the Performance league Table.

Initially, three different metrics will be used to assess performance. These are:

(i) an ***absolute metric***, which simply reflects the relative change in an organisation's CRC-EES emissions

(ii) an ***early action metric***, which takes into account energy saving measures an organisation put in place before the start of CRC-EES2

(iii) a ***growth metric***, which takes into account the fact that a growing organisation may have an increase in its absolute emissions by measuring change in emissions intensity. This metric therefore gives credit to organisations that are expanding in an energy efficient way.

The metrics will be weighted differently in the different phases as indicated in Table 1.1.

Table 1.1 The relative weightings of the three metrics used in determining the overall position in the Performance leaguer Table. Note that these are percentages as given in the Draft Legislation and may change by the time of implementation. Furthermore, the percentages are likely to be reviewed before the start of Phase 2 once experience with Phase 1 has been obtained.

	Description	Phase 1 Year 1	Phase 1 Year 2	Phase 1 Year 3	Subsequent Phases
Absolute Metric	This metric compares the current annual emissions to the average emissions over the preceding five years (or if 5 years information is not available, to the number of years that data are available).	0%	45%	60%	75%
Early Action Metric	This measure gives some recognition for good energy management undertaken prior to the start of the scheme. This metric is based on two factors, equally weighted, which have been chosen as a proxy for good energy management: (i) The percentage of non-mandatorily HH metered electricity and gas emissions which are covered by voluntarily installed automatic metering (AMR) by 31 March 2011. (ii) The percentage of the emissions covered by a valid Carbon Trust Standard or Energy Efficiency Accreditation Scheme certificate on 31 March of each compliance year.	100%	40%	20%	Not applicable
Growth Metric	This metric gives recognition to those organizations which are growing but emissions are growing as a slower rate. It compares the current emissions per units of output with those in preceding years	0%	15%	20%	25%

A CRC-EES Participant is not obliged to report anything other than the ***absolute metric.*** However, this will be a disadvantage to the organization since if there is a non-submission for either of the other metrics, the organization will receive no points for those metrics. On the other hand even if they were the worst performing organizations in the other two metrics they would at least get one point for each.

For each metric, points are awarded depending on the relative location of the organization in the league table for each metric. Thus if there are 1000 CRC-EES participants, then the best performing organization would receive 1000 points and the worst performing one point.

The income received from the purchase of allowances is recycled to participants, but the proportion received depends on

the relative position in the League Table. [Note: it is only the income allowance purchased at the fixed price in Phase 1 or the clearing price in future phases that will be recycled].

Bonuses/Penalties to the actual emissions are applied as shown in Table 1.2 which are the planned rates over the first five years. Subsequently these bonuses/penalties will be determined in the light of experienced gained in the first five years of operation. These bonuses/penalties will determine the payment to the organisation

Table 1.2 The proposed bonuses/penalties in the first five years of operation of CRC-EES.

Year	Maximum Bonus/Maximum Penalty
1	+/-10%
2	+/- 20%
3	+/- 30%
4	+/- 40%
5	+/- 50%

The position of any company is determined by identifying its relative position for each metric and then scaling these rankings according to the weightings shown in table 1.1. Thus if a company (**A**) had an ultimate position of 3903rd out of 5000 in the overall performance table, it would have performed worse than average and would incur a penalty.

The method of determining the penalty depends not only on the rank position 3903rd in this case, but also the position of the organization in the total overall emissions and also the size of that companies emissions.

To work out the bonus/penalty the total emissions must be known. Using the following information as an example:

- Company A (rank 3903) had total emissions amounting to 27000 tonnes,
- All companies ranked 1 to 3902 had total emissions of 12,500,000tonnes
- All companies ranked 3904 to 5000 had total emissions of 7,600,000 tonnes.

The total emissions of all 5000 companies would be:

12500000 + 27000 + 7600000 = 20127000 tonnes.

As a percentage, the emissions can be summarized as shown in Table 1.3.

Table 1.3 Calculation of key information for Company A.

Company	Starting Emission		End Emission	
	Absolute (tones)	percent	Absolute (tones)	percent
Companies with rank 1 to 3902	0	0	12500000	62.106%
Company A	12500000	62.106%	12527000	62.240%
Companies with rank 3904 to 5000	12527000	62.240%	20127000	100%

The final critical factor ***R*** to determine is the mid point for the company in question – i.e. ***R*** = (62.106+62.240)/2 = 62.173%).

If the maximum bonus is B_{max}
and the maximum penalty is P_{max}

Then the bonus/penalty for the company in question (B_A) can be evaluated as:

$$B_A = B_{max} - \frac{R}{T}(B_{max} - P_{max})$$

R is the factor as determined above

Thus in the second year, when the maximum bonus and penalty are +/-20% the bonus/penalty for company A would be:

$$\mathbf{20 - 0.62173.(20 - -20) = -4.896\%}$$

In more general terms , the factor ***R*** may be specified as:

$$\mathbf{R} = \frac{\frac{\mathbf{E_r}}{\mathbf{2}} + \sum_{\mathbf{i=1}}^{\mathbf{r-1}} \mathbf{E_i}}{\sum_{\mathbf{j=1}}^{\mathbf{N}} \mathbf{E_j}}$$

Where ***r*** is the rank position of the company in question
N is the total number of companies
E_i is the total emissions of company ***i.***

1.7 Example of financial benefit / penalty to two different organisations.

There are two companies who are full participants in the CRC-EES in which there a total of 5000 participants. In the assessment of operation of CRC-EES in 2012/2013, the relative positions of the two companies among all companies according to the three performance metrics are given in Table 1.4 together with the relative weightings of the different metrics. The maximum bonus and penalty in that year are +/-20%.

In the second year of CRC-EES Company A purchases 1900 allowances and ultimately emits 1800 tonnes, while the corresponding figures for Company B are 2600 and 2700 tonnes respectively.

If the total emissions from all companies remains static at 30000000 tonnes and allowances cost £12 per tonne examine the estimate financial benefit/penalty for the two companies if both companies trade in the secondary market at £15 per tone to cover any surplus/shortfall in allowances.

Table 1.3 Performance rankings of two companies

	Company A Ranking	Company B Ranking	Metric weighting
Absolute Metric	250th	3500th	60%
Early Action Metric	500th	3000th	20%
Growth \Metric	1000th	2400th	20%

Solution:

First work out the weighted overall ranking for both companies.

Company A = 250* 0.6 + 500*0.2 + 1000*0.2 = 450th
Company B = 3500*0.6 + 3000*0.2 + 2400*0.2 = 3180th

The total emissions for companies ranked 1st to 449th amount to 8500000, while the total emissions for companies 1st to 3179th are 10500000.

Total cost of initial allowances for the two companies is:
Company A = 1900*12 = £22800
Company B = 2600*12 = £31200

However,
company A has a surplus of 1900 – 1800 = 100 allowances
company B has a shortfall of 2700 – 2600 = 100 allowances

These have a value of 15*100 = £1500 on the secondary market.

Thus the overall price paid by company A will be £22800 - £1500 = **£21300**
While the overall price paid by company B will be £31200 + £1500 = **£32700**
Assuming that no additional allowances are purchased under the safety valve mechanism, the total payments for recycling will be:

£30000000 * 12 = £360 000 000

For company A the R factor (R_A) will be:

$$\mathbf{R_A = \frac{\frac{E_r}{2} + \sum_{i=1}^{r-1} E_i}{\sum_{j=1}^{N} E_j} = \frac{\frac{1800}{2} + 8500000}{30000000} = 0.28366}$$

Similarly for company B the factor (R_B)

$$\mathbf{R_B = \frac{\frac{2700}{2} + 8500000 + 10500000 + 1800}{30000000} = 0.63344}$$

The relative bonus/penalty for each company will be:

Company A = 20 - 0.28366 * (20 - -20) = 8.665%
Company B = 20 - 0.63344 * (20 - -20) = -5.338%

The recycled payments will thus be

Company A

1800/30000000 * 360000000*(1.08665) = **£23471.64**
| | |
Proportion of emissions | recycled payments | bonus

and the company will make a profit of £23472 - £21300
= £ 2172

Similarly company B will receive

2700/30000000 * 360000000*(1-0.05338) = **£30670**

And will therefore make a loss of 32700 – 30670 = **£2030**

1.8 Example of different metrics

The early action metric is relevant only in Phase 1 and thereafter the absolute and growth metrics.

Suppose Company A sees its turnover rise from £150000 to £160000 – a growth of 6.7%. and Company B grows from £200000 to £2200000 – a growth of 10%. In financial terms Company B has grown more rapidly than Company A. However, suppose company A has seen a reduction in emissions from 2000 tonnes in the footprint year to 1800 tonnes, an absolute reduction of 10% over the period while company B has seen an absolute increase from 2500 to 2700 tonnes, an increase of 8% .

The carbon intensity of Company A in the footprint year would be 2000 tonnes/£150000 or 0.01333tonnes per £1. This falls to 0.01125 tonnes/£1 in Year 2 an improvement of 15.6%. For company B there is still an improvement in carbon intensity from 0.0125 tonnes/£1 to 0.012273 but much less than company A at just 1.8%

1.9 Useful Links

The relevant documentation relating to CRC-EES may be found on the DECC (www.decc.gov.uk) and the Environment Agency (www.environment-agency.gov.uk) Websites and clones will also be placed on the UEA Energy Links Page in the near future: http://www2.env.uea.ac.uk/gmmc/energy/enpoint.htm

2 BUILDING REGULATIONS Part L Conservation of Fuel and Power

2.1.1 Summary

The current edition of Part L of the Building Regulations (2005) came into force on April 1st 2006 and replaced the 2002 regulations. Both of these come under the general heading of Building Regulations 2000. These are the latest in a line of Regulations which have been progressively updated with regard to Energy Conservation since they first appeared as Part L in the 1976 Regulations.

On October 1st 2010 new 2010 Regulations will come into force although in many respects they are similar in basic provision to the 2005 Regulations. These notes summarise the development of the regulations with summary notes on the main differences of the new Regulations. However, there have been a number of variations in the actual wording and provision of the latest regulations and the information within this section is correct at the time of preparation in mid July 2010.

There are sometimes some confusions regarding the different Regulations. Thus the 2000 Regulations did not actually com into force until 1st April 2002, and the 2005 regulations until 1st April 2006. Thus sometimes 2000 Regulations and 2002 Regulations are used interchangeably, even though they are the same regulations.

The 1994 regulations (implemented on 1st April 1995) were a noticeable improvement on previous regulations, and unlike previous regulations did attempt to address the issue of overall energy requirements. This concept was extended in the 2002 (2000) Regulations and subsequently in the 2006 (2005) Regulations, and although improved still suffered from deficiencies.

On 1st May 2008, a further development took place in which the Code for Sustainable Homes came into force. This code is more embracing than just energy but has the ambition of requiring all new homes to be zero-carbon homes by around 2015. Whether this will actually be achieved is another matter. The basis of the Code has six steps 1 to 6 with code 5 (zero carbon) supposedly coming into force in 2015. As will be seen in section 2.2, the different code levels represent different levels of improvement of the energy performance over the 2005 regulations

The section of the Building Regulations dealing with Energy Conservation is Section L, often referred to as Approved Document L "Conservation of Fuel and Power" (or ADL). In 2002, ADL became available on the WEB and is divided now into two sections ADL1 for domestic premises, and ADL2 for other buildings. Belatedly the 1994 Regulations were published on the WEB.

The Regulations are now further divided into ADL1a and ADL1b, the former referring to new dwellings whereas the latter refers to existing dwellings In similar way Part L2 is divided in ADL2a and ADL2b for new and existing buildings. Dwellings are defined as individual household units – so the UEA student residences would come under ADL2a.

In the Energy White Paper (February 2003), the Government declared the aim of bringing forward the next revision of the Building Regulations to 2005 for implementation later that year or by 2006 to comply with EU legislation. Government Consultations in 2008 and 2009 led to the new 2010 Regulations being drafted for implementation on 1st October 2010.

As a background, the following Table tracks the key changes with regard to insulation levels that have taken place over the years. Copies of all recent building regulations are available on the Energy Links WEB Page.

http://www2.env.uea.ac.uk/gmmc/energy/enpoint.htm

while specific links will be indicated in the relevant sections below.

TABLE 2.1.1 Summary Table of U-values for different Building Regulations (Dwellings) – initially specified in approved document ADL, then ADL1 and currently ADL1A.

	1976	1985	1990	1994		2000	2005	2010	
	U – Values W m^{-2} $^oC^{-1}$								Determining
				SAP < 60	SAP > 60				TER ***
External Wall	1.0	0.6	0.45	0.45	0.35	0.45	0.35	0.30	0.35
Party Wall								0.20	0
Roof	0.6	0.35	0.25	0.25	0.16	0.25	0.16	0.20	0.16
Floor	1.0	0.6	0.45	0.35	0.25	0.45	0.25	0.25	0.25
Windows	not specified	not specified	not specified	3.0	2.0*	3.3	2.0	2.0	2
Windows as % of external walls	equivalent to 17%	12	-						
Windows as % of total floor areas	-	-	15	22.5	25	22.5	25%		25%
Air Permeability $m^3/h2/m^2$ @ 50Pa								10.00	10.0

* 2.2 if the window frame is metal

** In the 2005 and subsequent regulations there is no compliance procedure based solely on U-Values. The specified U-Values are those to be used in the Target Emissions Rating for the dwelling.

*** The Target Emission Rate (TER) is used for compliance post 2005. It refers to a reference building constructed to 2002 regulations according to Appendix R of SAP 2009.

2.1.2 Deficiencies in Earlier Building Regulations.

- Until the implementation of the 1994 Regulations in 1995, if double glazing was used, then area of windows could be doubled. There was thus little incentive to encourage double glazing and potential energy saving.
- Traditionally if double glazing was used, then requirements for walls/roof/floor could be relaxed provided that the overall loss does not exceed that of a house of same overall size and built to conform to the relevant Building Regulations. This is a Trade off of type 1.
- From 1985, it was possible to include incidental gains from appliance use/ solar gain etc. and it could be demonstrated

that consumption in year was no greater than standard house, then regulations could be relaxed further.

- The 1994, 2000 and 2005 regulations do address problem of overall running costs, but continue to allow trade off. Thus if in then 1994 Regulations, triple glazing was used then window area could be effectively increased by 50%. This was Type 2 trade off. In the latest Regulations, triple glazing or double glazing with low emissivity is required, and this type of trade of is no longer possible.
- If higher insulation standards are applied to walls then even more window area is permitted provided that the overall heat loss does not exceed that of a similarly sized house built to specified standards. This was effectively the statement of Compliance. In the 1994 Regulations this was considered by the Target – U Value method as an alternative to meeting the requirements for each individual fabric element. In the 2005 and 2010 Regulations a similar situation occurs with the Dwelling Emission Rating (DER) when compared to the Target Emission Rating (TER).
- Traditionally, Building Regulations have thus been framed in a way for minimum compliance rather than to actively promote conservation – the idea behind this has to promote flexibility and innovation. In the 2005 Regulations this minimum compliance issue has been tightened to restrict flexibility (see section 1.6.2). Further restrictions are included in the 2010 Regulations
- None of the previous Building Regulations specified a maximum ventilation rate, and with significant improvements to fabric losses, ventilation losses are becoming proportionally more important in percentage terms. The later regulations including the current one do however give procedures to estimate the ventilation rate within the Standard Assessment Procedure, and indeed specify a maximum air permeability value..

2.1.3. Effect of Different Building Regulations and Construction Type (Built Form) on Energy Consumption

This section explores the impacts that differing regulations have had on the same house design and also the effect of construction type.

Table 2.1.2 shows the effect of the various regulations on energy consumption. In each case it is assumed that the overall shape of the house is identical – i.e. 7m x 7m x 5m high with 15 sq m of window area. .

TABLE 2.1.2 Comparison of Energy Consumption for a standard detached house 7m x 7m x 5 m high with 15 sq m of windows – at various ages and improvements

		Heat losses in W $^0C^{-1}$					
		Walls	Windows	Floor	Roof	Ventilation	Total
pre-war	unimproved	263	86	32	146	177	703
pre-war	loft insulation (25mm)	263	86	32	45	177	602
pre-war	loft insulation (50mm)	263	86	32	28	177	586
pre-war	loft insulation (100mm)	263	86	32	17	177	574
pre-war	loft insulation (100mm) + standard double glazing	263	43	32	17	115	469
pre-war	loft insulation (200mm) + triple glazing	263	30	32	9	88	422
post-war	unimproved	200	86	32	78	155	551
post-war	loft insulation (25mm)	200	86	32	39	155	512
post-war	loft insulation (50mm)	200	86	32	26	155	499
post-war	loft insulation (50mm) + cavity insulation	66	86	32	26	133	343
post-war	loft insulation (100mm)	200	86	32	16	155	488
post-war	loft insulation (100mm) + cavity insulation	66	86	32	16	133	332
post-war	loft insulation (100mm) + standard double glazing	200	43	32	16	106	397
post-war	loft insulation (100mm) + standard double glazing + cavity insulation	66	43	32	16	97	254
post-war	loft insulation (200mm) + triple glazing + cavity insulation	66	30	32	9	88	226
1960's	Unimproved	125	86	32	78	155	476
1960's	loft insulation (25mm)	125	86	32	39	155	437
1960's	loft insulation (50mm)	125	86	32	26	155	424
1960's	loft insulation (50mm) + cavity insulation	50	86	32	26	133	326
1960's	loft insulation (100mm)	125	86	32	16	155	413
1960's	loft insulation (100mm) + cavity insulation	55	86	32	16	133	321
1960's	loft insulation (100mm) + standard double glazing	125	43	32	16	106	322
1960's	loft insulation (100mm) + standard double glazing + cavity insulation	55	43	32	16	97	243
1960's	loft insulation (200mm) + triple glazing + cavity insulation	55	30	32	9	88	215
1976	unimproved (includes 50 mm loft insulation)	125	86	32	26	133	401
1976	cavity insulation	55	86	32	26	115	314
1976	loft insulation (100mm)	125	86	32	16	133	391
1976	loft insulation (100mm) + cavity insulation	55	86	32	16	115	303
1976	loft insulation (100mm) + standard double glazing	125	43	32	16	106	322
1976	loft insulation (100mm) + standard double glazing + cavity insulation	55	43	32	16	106	252
1976	loft insulation (200mm) + triple glazing + cavity insulation	55	30	32	9	88	215
1985	unimproved (includes 100m loft insulation)	75	86	29	17	88	295
1985	standard double glazing	75	43	29	17	88	253
1985	standard double glazing + cavity insulation	56	43	29	17	88	234
1985	loft insulation (200mm) + triple glazing + cavity insulation	56	30	29	9	88	213
1990	unimproved (includes 150m loft insulation)	56	86	22	12	88	264
1990	standard double glazing	56	43	22	12	88	222
1990	loft insulation (200mm) + triple glazing	56	30	22	9	88	206
1994	unimproved (includes 200mm loft insulation + standard double glazing	56	45	17	12	88	219
2002	unimproved (includes 250mm loft insulation + standard double glazing	56	45	17	10	84	212
2006	unimproved (includes 250mm loft insulation + Window U- Value 2.0)	44	30	12	8	79?	173
2010	unimproved (includes 250mm loft insulation + Window U- Value 2.0)	38	30	12	9	75?	165

Note: some improvements are not relevant. i.e. a house which already had double glazing could not have triple glazing fitted.

The figures for the 2005 and 2010 regulations show improvements on 2002, but part of this comes from assumed improvements in ventilation requirements which are still relatively large and approach the minimum requirements by 2010. There apparently some oddities in that the U-values in 2005 and 2010 are sometimes inferior to those in earlier years. The main difference lies in the fact that the U-values in earlier regulations were target values, and although areas of thermal bridging were to be minimised, there were no detailed checks on this. In the latest regulations, the U-values for the different fabric components are the area-weighted dwellings averages taking account of thermal bridging etc.

It is noteworthy that the same size and shape of house built to the 2000 Regulations as was one which conformed to the 1976 regulations would consume less than 50% of the consumption of the 1976 house. This is an important issue as small incremental changes in Building Regulations will not be conducive to effective reductions in emissions as some aspects limit further improvement by later upgrading. Thus the lack of insulation under the floor in early regulations cannot be addressed in later improvements unless these modification include a major renovation of the building – i.e. tearing up the floors.

The remaining part of this sub-section reviews variations in energy demand for different types of construction i.e. house/ bungalow/ flat. All built forms are assumed to have the same total floor areas of 98 sqm, with a plan area of 49 sqm in two storey buildings, and 98 sqm in a single one storey unit. The results are shown in Table 2.**1.3**

The plan shape is assumed to be square, giving a 7 m x 7m construction for a two storey house and a 9.8 m x 9.8 m for single storey construction. It is assumed that all units have 15 sq m of window. The comparison is done for 2000 Regulations with a comparison also with the 1976 regulations.

TABLE 2.1.3 Effects of Built Form on Energy Consumption

	Roof	Floor	Wall	Window	Wall	Window	Total	Vent.	2002	1976
	Losses	Losses	Area	Area	Losses	Losses	Losses	Losses	Total Losses	Losses
detached house	7.8	12.3	125.0	15.0	43.8	30.0	93.8	88.4	**182.3**	465.8
semi-detached house	7.8	12.3	105.0	15.0	36.8	30.0	86.8	88.4	**175.3**	445.8
terraced house	7.8	12.3	55.0	15.0	19.3	30.0	69.3	88.4	**157.8**	395.8
detached bungalow	15.7	24.5	84.0	15.0	29.4	30.0	99.6	88.4	**188.0**	503.2
semi-detached bungalow	15.7	24.5	59.2	15.0	20.7	30.0	90.9	88.4	**179.4**	478.4
bottom end flat	-	24.5	59.2	15.0	20.7	30.0	75.2	88.4	**163.7**	419.6
top end flat	15.7	-	59.2	15.0	20.7	30.0	66.4	88.4	**154.9**	380.4
mid-storey end flat	-	-	59.2	15.0	20.7	30.0	50.7	88.4	**139.2**	321.6
bottom centre flat	-	24.5	34.5	15.0	12.1	30.0	66.6	88.4	**155.0**	394.9
top centre flat	15.7	-	34.5	15.0	12.1	30.0	57.8	88.4	**146.2**	355.7
mid-storey	-	-	34.5	15.0	12.1	30.0	42.1	88.4	**130.5**	296.9
centre flat	-	-	34.5	15.0	12.1	30.0	42.1	88.4	**130.5**	296.9

Heat Losses in W^oC^{-1} for different types of dwelling of same area and volume

2.1.4 The 1994 Regulations – the first significant step.

2.1.4.1 Introduction

Prior to the 1994 Regulations, the energy conservation was primarily concerned with the "U-"values of the different elements of the fabric (i.e. the walls, floor, roof, windows). There were opportunities in the regulations in the late 1990s to consider overall energy loss as an alternative means of satisfying the regulations, but there was little guidance on how this might be down, and implied that it had to be left to a competent person to do such calculations. The 1994 regulations saw some major changes over and above the normal changes to U-values etc. seen in previous versions. Not only were U-values improved, in some cases substantially, but a standard methodology was adopted for calculating overall energy requirements. This was known as the Standard Assessment Procedure or more commonly as the SAP Rating. To avoid confusion with the current regulations, the SAP Rating will be referred to as the SAP 1994 Rating

2.1.4.2 Developments of the 1994 Regulations

Some of the key developments of the 1994 Regulations were:-

- Single glazing could no longer be used routinely for domestic buildings (it could be used subject in trade-offs – see later).
- The glazed area could now be as high as 22.5% of floor area. This is 50% larger than the 1990 regulations, so though double glazing is now used 50% of the potential saving is lost because of the relative increased window area. It is true that solar gain would be increased slightly by larger windows, but the extra with double glazing does not outweigh the additional losses from an increased area.
- A SAP 1994 (or Standard Assessment Procedure) rating had to be computed for new dwellings. This was a crude index of how good the energy performance of a house was ranging from 0 for very bad to 100 for very good. Theoretically it was possible to achieve a rating of 115 although values over 100 were rare. The idea behind having a scale which could theoretically exceed 100, really meant that the buildings would have a higher rating than they deserved, and was probably to placate the Building Industry.
- While the 1994 regulations did not specify ventilation rates, they did give advice on how to estimate ventilation rates.
- The regulations did make allowance for solar hot water heating if fitted.

- The regulations did include hot water requirements as well as space heating.

2.1.4.3 Compliance Requirements of the 1994 Regulations

Compliance is the procedure whether a building passes or fails the requirements of Part L of the building Regulations. Previously the majority of compliance centered around achieving specific minimum values for U-values, although there was scope for variations if it could be demonstrated that a building consumed no more energy than one of the same dimensions which did achieve the required U-Values. In the 1994 Regulations, three separate methods of compliance were possible:

- **Compliance using the elemental method approach** – This was essentially a requirement to achieve minimum U-Values and is discussed more fully in section 2.1.5.3 where it is discussed in the context of the 2002 Regulations which also allowed such a method of compliance. Compliance by the Elemental Method is the approach still used in several countries.

- **Compliance using a Target U-Value approach.** This was a formalization of the previous methods to encourage innovation by setting an overall energy consumption level. This compliance approach was further refined in the 2002 Regulations where more details are covered in section 2.1.5.3.

- **Compliance using the SAP Rating**. In the 1994 Regulations, there was ***NO*** requirement to reach a particular SAP, but requirements could be relaxed if SAP > 60. However, if a building had a SAP rating in excess of 80 – 84 (depending on building size), it would automatically satisfy the Building Regulations, even if the "U" – values were higher than those stipulated. Thus fitting a solar panel or a condensing boiler and it was possible to have less stringent insulation!!!!! See section 2.1.7 for a critique of the SAP Rating System.

- The SAP 1994 Rating takes into account method of heating, and once again it was possible to relax the insulation standards if there was a more efficient heating system!!

The SAP Rating system was supposed to be concerned with reduction of CO_2, but the method of analysis for determining the SAP 1994 Rating was (and still is in SAP 2001) solely usurped by monetary issues leading to the rating giving potentially very misleading information**.** While the approach in SAP 2005 and SAP 2010 is much better, there are still issues which are far from satisfactory.

2.1.5 Building Regulations 2000 (implemented 1st April 2002)**.**

2.1.5.1 Introduction

The 2000 regulations which were valid from 1st April 2002 until 6th April 2006 in effect down played the relevance of the SAP Rating, although it was expected that these would still be computed. Revised SAP calculations were published in 2001 and known as SAP 2001. Both the Building Regulations 2000 and SAP 2001 came into force on 1st April 2002 and are sometimes referred to as the 2002 Regulations even though they were originally published in 2000.

2.1.5.2 Main Differences of 2000 Regulations

- Approved Document L were divided into 2 parts:-
  a) Approved Document L1 "Conservation of fuel and power in dwellings"
  b) Approved Document L2 "Conservation of fuel and power in other buildings"

- Effects of Boiler Seasonal Efficiency, particularly in respect of Hot Water provision were included. The SEDBUK database covering gas and oil boilers may be accessed at: http://www.sedbuk.com/index.htm

- The standards of fabric insulation were improved, by setting lower standards and also changing methods for calculation.

- The 2000 regulations saw further reductions in U-Values for all key components see table 2.1.1. Indeed they were now approaching the technical limits with ***traditional*** brick built buildings (i.e. outer brick, inner block and 50 mm cavity). The new regulations for glazing were more stringent as triple glazing (or triple glazing equivalent – i.e. double glazing with low-e glass) would normally be required.

- There was however an increase in the allowable glazed area as a proportion of floor area to 25% (from 22.5% in 1994 and 15% in 1990). This does mean that if the actual percentage of glazed area is much less than this figure, then low performing windows could still be used. It appears that designers are being given flexibility here – large areas of windows with low U-value windows or smaller areas with higher U-value.

- The 2000 regulations were also more demanding in the case of loft insulation as it is no longer possible to put boards down in a loft – for potential storage. Instead two layers should be installed – one lying between the joist and the other at right angles.

- Unlike the 1994 regulations meeting a target SAP rating of 80 – 84 no longer applied, but there was a requirement to make a SAP 2001 calculation to provide some continuity with the previous rating scheme (particularly for those selling new houses).

- Restrictions on the extent of Trade-offs were incorporated particularly on extensions to existing buildings, although there does seem some extra flexibility with regard to the inclusion of trade-off between efficient boilers and U-values in the Elemental Method (see section 2.1.5.3 for a discussion about the Elemental approach).

- The SAP rating as a means of compliance was dropped. This was a significant improvement. However, SAP ratings must still be completed to the 2001 and subsequent procedures and notified to the Building Control Authority for New Buildings.

- A New Carbon Index Method replaced the SAP rating as a means of compliance. The concept of this was a significant improvement. However, the actual implementation was still not sending the correct message as it also had major deficiencies. For instance the Elizabeth Fry Building would have rated 13.5 out of 10!!!!!! (see section 2.1.5.3 and 2.1.10 for a further discussion of this issue).

- There were also several other smaller changes of detail on the precise methods for calculating some aspects of the analysis.

- Much of the SAP 2001 and SAP 2005 rating calculations remains the same as the SAP 1994 method, although there are some important changes. An important difference in the 2001 was a completely new set of energy prices is included, as is the so called energy cost deflator which is now set as 1.05 as opposed to 0.96 in the 1994 Regulations. As with the 1994 regulations, the SAP Rating is really an attempt at an economic, rather than energy rating of the house. It attempts to include energy running costs in the calculation. This greatly increases complexity, and continues to create anomalies – see section 1.7.
- For the 2005 and 2010 Regulations there were further changes in the way economic factors were included in the SAP Rating – see section 2.1.9

2.1.5.3 Compliance Requirements in the 2002 Regulations.

In the 2002 Regulations, the methods available for compliance were changed and there were three different methods whereby the thermal performance of a building can be demonstrated to comply with the Building Regulations

- **The Elemental Approach**
- **The Target U-Value Method**
- **The Carbon Index method**

None of these methods now satisfy compliance although the Elemental Approach is still used in some countries. The Target U-Value Method was an early development to allow flexibility in design and the method now used (Target Emission Rate (TER) method) is, in essence as development of this Target-U-Value. For completeness, all the above compliance methods are covered below.

The Elemental Approach as modified for the 2002 Regs)

Note in some countries – e.g. China, India, the Elemental Approach is used with out the following restrictions which are marked with a **(*)**.

The following questions had to be addressed (2002 Regs):-

- Is heating by gas or oil boiler, heat pump, District Heating with CHP, biogas or biomass fuel? If the answer is **NO** (i.e. normal electric heating or coal), the Elemental Approach cannot be used **(*)**.
- Are all the U-values <= to those specified in the Table in section 1.1 for 2000?
- If this condition is not satisfied, then the Elemental Approach cannot be used.
- Is the area of windows, doors and roof lights <=25%. If the answer is **NO** (i.e. normal electric heating or coal), the Elemental Approach cannot be used.
- If a gas or oil boiler is used, is the SEDBUK efficiency >= 78% for gas (80% for LPG, or 85% for oil). If the answer is **NO** (i.e. normal electric heating or coal), the Elemental Approach cannot be used **(*)**.

[the implications of the SEDBUK efficiency are discussed in the next section].

If the answer to all the questions is YES, the building automatically satisfied the requirements of Approved Document L1.

The Target U-Value Approach

The following stages are followed

- Calculate the Target U-value from the Specified Target U-Value Equation. [This is somewhat involved, and may be read in full in Section 1.18 of the Approved Document

http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/L1_MAIN.PDF].

This Target U-value is a function of areas of floor, roof, walls, windows etc.

- Modify this Target value by multiplying it by a factor of

  actual SEDBUK efficiency
  ---------- for gas and oil boilers
  standard SEDBUK efficiency

  [standard efficiency is 78% for gas, 80% for LPG, 85% for oil] or dividing by 1.15 for electric or coal heating.

  [for heat pumps, biomass, biogas, CHP no modification is done]

- Modify the Target value if area of windows which face south exceeds the north facing windows area.
- Calculate the weighted average U-value of all external surfaces.
- If the weighted average U-value is <= Target value, then the requirements of Approved Document L1 are satisfied.

  Note: This method can give considerable flexibility in design, e.g. If area of windows is lower than maximum 25% permitted, the U-values of say walls can be reduced. However, this does not encourage higher standards of thermal insulation.

  If a condensing gas boiler is used, the Target U-Value is higher and much easier to achieve. However, this could present a serious problem, as if the insulation levels were relaxed and a condensing boiler fitted, what happens in the future when the boiler is replaced. At the time there was nothing to stop fitting a non-condensing boiler at a later date. More recently the regulations covering the installation of boilers have been tightened to ensure that only condensing boiler can be fitted as replacements.

Carbon Index Method

This is the most complex of the three methods as far as calculation are concerned. Essentially, the SAP procedure was followed [see section 2.1.8] up to the point at which the costings of fuels are introduced. At that point, the actual annual energy consumption was used to compute the annual carbon dioxide emission and this is then translated into an index [section 2.1.10], and if the **carbon index >= 8**, the requirements of Approved Document L1 were satisfied.

There was an apparent maximum carbon index of 10, so to satisfy the Building Regulations by this means it would appear at first site that a building scoring 8 out of 10 is probably quite good. However, as will be shown in

section 2.1.10, the actual scale is out of 17.7, and anything above 10 is truncated to 10. In reality a building scoring 8 is really only scoring 8 out of 17.7 or a real rating of 4.5 out of 10. It would appear that once again the Building Industry have had an impact as a true scale of 4.5 out of 10 would not appear very good.

In SAP 2005, there was a major overall of many sections mainly in the use of parameters to be used in the different sections. Thus there were more options for different boiler types including the opportunity to specify actual efficiencies where these are know. These additional options are carried over into the 2010 Regulations.

2.1.6 The 2005 Building Regulations (came into force on 6th April 2006).

The 2005 revision of the Building Regulations was brought forward and initially flagged in the Energy White Paper (2003). Part of this reason was the impending EU legislation which will require a significant change in the way Building Regulations are managed. In particular, there was the requirement for a Home Information Pack (HIP) which, it is intended to give potential purchasers not only the design specification as afar as energy consumption is concerned, but also information on actual energy consumption. This means that each time a house changes hands a HIP must be produced, and that the information must be updated by a competent person at regular intervals. Thus a house sold twice, the second time say 10 years after the first will not be allowed to use the Energy information for the original HIP even if there have been no changes in the building. However with the new Government from May 2010, the requirement for HIPs is no longer required.

The 2005 Regulations represent a much more substantive change in Regulations than anything previously apart from the changes introduced in 1994.

The 2010 Regulations have relatively minor changes on the 2005 Regulations.

2.1.6.1 Technical Changes in the 2005 Regulations.

The Government Department for administrating Building Regulations was originally the Office of the Deputy Prime Minister (ODPM) and this was replaced by the Department of Communities and Local Government

http://www.communities.gov.uk/

As with many Government Departments the location of key documents kept changing and the key relevant documents for the Building Regulations 2005 are now available on the UEA WEBSITE as:

- http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/adl1a_id1164337.pdf for new dwellings
- http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/adl1b_id1164338.pdf for existing dwellings
- http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/adl2a_id1164339.pdf for new non-domestic buildings
- http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/adl2b_id1164340.pdf for existing non-domestic buildings

The key changes in the 2005 Regulations (now incorporated in the 2010 Regulations) were:

- Issues such as thermal bridging came to the forefront. Such bridging can negate efficient insulation levels. The Regulations indicate requirements of how to assess and deal with thermal bridging.
- Pressure testing of dwellings to assess ventilation rates became more common in any development over a certain size (in terms of house numbers). In such cases a minimum percentage of the houses must be tested for air-leakage.
- U-value calculation of windows must taken into account the area of the frames
- Information on lighting use must be included
- Estimations of potential overheating in summer must be included.
- Shading issues relating to solar gain etc must be addressed
- Ventilation rates achieving a specific level are still not specified although for some developments there is the requirement for pressure testing of dwellings.

2.1.6.2. Compliance in 2005 and 2010 Regulations

Perhaps the biggest change is in the way compliance is achieved. There are now five separate Criteria which must be met (see the WEB links in section 2.1.6.1).

It was inevitable that a completely new set of criteria would be needed as it would have been impossible to carry the previous method of compliance via the Carbon Index forward see section 2.1.5.3 for a discussion on the limitations of this method.

The following criteria now need to be addressed to ensure compliance:

- ***Criterion 1***

  A Dwelling Emission Rating (**DER**) must be calculated taking due account of the U-values, the size, the types of heating etc using the Standard Assessment Procedure (SAP) – note this part of the SAP calculations are fine – it is the subsequent use of a SAP Rating which is nonsensical (see sections 2.1.8 and 2.1.9). The **DER** must be shown to be less than the Target Emission Rating (**TER**) which is computed with the same size and shape of building and U-values meeting those in 2002 in Table 1.1 Further details of how the DER is calculated are summarised in section 2.1.11, however, for a detailed discussion you should consult the WEB link for new dwellings given in section 2.1.6.1. In addition details of the actual calculations (2005) may be found in:-

  - http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/Final_SAP2005_text.pdf for the main text
  - http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/Final_SAP2005_tables.pdf for the associated tables
  - http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/Final_SAP2005_worksheet.pdf for an example worksheet.

The corresponding links to the Draft 2009 SAP methodology which are still under revision may be found at:

- http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/SAP-2009_9-90.pdf for the main text
- http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/Draft_SAP_2009_tables.pdf
- for the associated tables

- http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/Draft_SAP_2009_worksheet.pdf
- for an example worksheet.

- ***Criterion 2 – limits on design flexibility***
  The performance of the building must not be worse than a given standard. In theory Criterion 1 gives considerable latitude in design – the old trade-off problem. For instance Criterion 1 could be satisfied by including renewable energy to offset a poor thermal insulation. However, in say 10 – 20 years time there is nothing to stop the renewable energy device from being stripped out and hence there would be an inferior building. This criterion attempts to limit this type of trade-off – see pages 5 and 6 of the Approved Document http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/adl1a_id1164337.pdf

- ***Criterion 3 – Limiting effects of solar overheating***
  This criterion requires that the effects of overheating in summer must be assessed and suitable measures must be included to control such gain – e.g. avoiding excessive use of south facing windows, provision of suitable ventilation etc.

- ***Criterion 4 Quality of Construction***
  When submitting plans for approval, all calculations are based on predicted performance. This criterion requires evidence of actual performance – e.g. changes arising from design modifications, quality of workmanship. Some of the requirements involve pressure testing the building to ensure they have achieved those used in the design specification.

- ***Criterion 5. Providing Information***
  This criterion requires information on the maintenance and operation of the building to be made available and eventually this will become art of the Home Information Pack

2.1.7 A critique of the Standard Assessment Procedure SAP (1994) with different strategies (discussions of the differences of SAP 2001 and SAP 2005 follow in subsequent sections)**:-**

The SAP Rating was initially an attempt to incorporate all the energy uses in a house and provide an index which may be used to illustrate how energy efficient a house is. The mechanics of the calculation procedure are explained more fully in section 1.8

Some experimentation by Monahan (2002) and Turner (2003) suggest that many of the anomalies of the 1994 SAP method remain through to SAP 2001.

Monahan, J. (2002) Msc Dissertation UEA
Turner, C. (2003) BSc Dissertation UEA

Turner also noted that there were limitations when applying the procedures to existing houses, particularly when there were variable temperatures in different rooms. As yet a comparable assessment of the current SAP 2005 standards has yet to be done

The following table shows typical changes in SAP Rating following specific changes as indicated. Because the SAP rating is essentially a monetary assessment, and because for some fuels (e.g. electricity, the standing charge is ignored, even when there is one), and others it is included, the SAP Rating can give misleading information.

Effective Changes in SAP rating with specified changes (based on 1994 regulations).

	SAP changes by
Change U-values by 10%	2 – 3
Change window area by 10%	1 – 2
change floor area by 10%	4 – 5
change heating from mains gas to LPG (appears odd because there is little difference in overall energy consumption)	-15
change heating from condensing gas boiler to inferior oil standard boiler. this arises solely because the rating ultimately depends on relative cost	+5 - 10!!!!!!! –

Some of these made a mockery of whole process.

- The SAP Rating Procedure adds considerable complexity to analysis procedure by trying to assess internal temperatures in a living room which is arbitrarily sized compared to rest of house. The effects of this compensation are fairly minimal anyway.

  Though the final SAP Rating can no longer be used to demonstrate compliance of Thermal Performance in the latest Regulations (i.e. post 2002), the calculations still must be done to satisfy the general Building Regulations.

- The SAP calculation only assume a general heating level in a house (one living area and all other rooms standard).

- The calculation requires a knowledge of hot water requirements which is based on floor area formula rather than occupancy, and may thus differ widely from reality. (Alcantar, 2008 – Phd Thesis, UEA did developed a revised method to more objectively account for hot water based on occupancy rather than floor area).

- Incidental gains also based on floor area rather than occupancy – i.e. with a higher number of occupants the incidental gains from extra appliance use, extra body heat, and extra incidental gains from hot water will be higher.

  However, what is it realistic to do here as house may have different numbers of occupants at different times.

- Ultimately the calculation gives a rating which is economically based rather than energy based. Serious errors in message conveyed by rating can occur because of relative fuel price distortions.

  e.g. fixed charge for gas included, but not electricity (oil does not have a fixed charge anyway).

- Consequence,
  a lower efficiency oil heating appliance can often give a higher SAP than a more efficient GAS system. This is an odd state of affairs as the regulations are supposed to be saving energy !!! - but they reflects the over emphasis on monetary values

- A more bizarre situation could arise in an ultra insulated house, as electricity which has no standing charge could work out with a higher rating than gas.

- The Energy Cost Deflator adds an unnecessary complication and is in place to allow for inflation - if only rating was given in Energy terms this would be avoided entirely. The Energy Cost Deflator was adjusted from 0.96 in 1994 to 1.05 in 2001 and further changes were made in 2005 and 2010 in an attempt to ensure that the SAP remains approximately the same for the same house. This once again is the consequence of a monetary approach. While aggregate fuel

prices may be adjusted correctly by the Deflator, the relative standing of one fuel with another may change meaning that changes in SAP Rating will take place purely on the choice of how the Deflator is calculated.

- With the 1994 Regulations it was theoretically possible to achieve a SAP rating over 100 – in fact as high as 115. It would appear that the formula chosen to calculate this was chosen to ensure that at SAP Rating of 100 could be achieved with current technology without too much difficulty. The consequence is that with more stringent regulations in 2000 it was necessary to widen the scale to 120 to allow possible higher ratings being achieved and yet keep SAP ratings of house defined under 1994 regulations approximately at the same value. This is undesirable as it means that that the range is likely to change again in the future, and a much better method would have been to have had a scale that achieved 100 say only is the house was a zero energy house as far as heating was concerned. This latter aspect has been addressed in 2005 Regulations with 100 only scoring with a zero energy house and 100+ if the house is a net exported of energy. The problem with this is that SAP calculation done previously for new buildings prior to 2005 are now invalid and will see the SAP rating fall (significantly in some cases).

  The continued insistence on monetary values as the primary means for defining SAP will always lead to anomalies in the final value, particularly in times of rapidly changing fuel prices, particularly when the differentials between different fuels change dramatically.

  Having criticised the SAP procedure, it is only the last part – i.e. where it attempts to bring in monetary values that problems arise. Generally the standard procedure approach for calculating actual energy use and emissions (subject to some qualifications) is good.

  It is true that a house should be assessed irrespective of occupancy and assessing values in terms of floor area does make some sense. However, this will not allow accurate comparison with energy consumption with a particular occupancy level. Summary details of the SAP Procedure are given in the next two sections.

2.1.8 The Standard Assessment Procedure – 1994 and 2001.

The SAP 2001 requirements were published in December 2001 and may be found at:

http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/Sap2001.pdf

Both the 1994 and 2001 Procedures are largely the same with a few minor points of difference. For the 2005 version see section 2.1.9. The SAP procedure works through the following steps.

1) Determine the U-Values for all the components, or use standard tables where relevant
2) Check that U-values are actually achieved (in cases where multiple construction is used it may be necessary to prove that bridging effects do not adversely affect U-value.
3) Work out gross overall heat requirement (Heat Loss Rate)
4) Determine overall hot water requirements
5) Determine incidental gains and also solar gains
6) Work out effective gains (i.e. not all incidental and solar gains are useful)
7) Compute an effective internal temperature - this will be dependant in part on mode of control provided, and noticeable improvements in SAP rating are possible just by changing control = e.g. zone control, thermostatic radiator valves (TRV's) etc.
8) Evaluate corrected degree-day parameter
9) Estimate net space heating total energy requirement.
10) Select Heating Method
11) Include energy requirements for pumps etc.
12) make allowance for appliance efficiency and determine **corrected Total Energy Requirement** from (5), (9) and (11).

    The above procedures are also required in calculating the Carbon Index (section 2.1.10 for 2002 Regulations) and the Dwelling Emission Rating (for 2005 and 2010 - section 2.1.11)

13) estimate energy costs of total space heating, hot water and pump at 1994 prices (or 2001, 2005, 2010 prices as relevant)

14) Deflate energy by Energy Cost Factor (which is related to floor area) and use standard formula to compute SAP. Deflator was 0.96 for SAP 1994 and is 1.05 for SAP 2001.

Note: There are fixed fuel prices declared in both 1994 and 2001 SAP rating methods, but also tariffs such as the 24 hour heating tariff which in reality was never available.

2.1.9 SAP Rating for 2005 & 2010 Regulations.

While the basic methods of calculation are generally similar in the 2005 Regulations to those used previously, the computations are more complex and take into account other factors such as the proportion of the windows, covered by frames, the extent of solar heating etc.

However, the most significant effect is the compete recalibration of the scale. Whereas the SAP Rating in 2001 meant that approximately the same rating would be given to a house calculated on the 1994 regulations, a house which already has a SAP rating from a previous pre-2005 assessment will find it reduced under the new procedures. This is a further reason why the final stages of the SAP Rating analysis are meaningless and should be abolished. The initial stages are fine as they are used for the Carbon Index (2000 Regulations), and the new DER calculations.

It is the attempt to relate the SAP Rating to monetary values which is the problem in the SAP Rating, particularly in a time of fast changing energy prices.

SAP 2005 RATING – the Energy Cost Factor (ECF)

The **SAP 2005** rating is related to the energy cost factor by the equations:

if ECF ≥ 3.4, SAP 2005 = 111 – 110 × log10(ECF)…… (1)
if ECF < 3.4, SAP 2005 = 100 – 13.96 × ECF ……(2)
where ECF = Energy cost factor, calculated in box (99) or (99*) of the Worksheet in SAP 2005.

SAP ratings can also be obtained by using Table 14 of the SAP2005 tables see.
http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/final_sap2005_tables.pdf

SAP 2010 RATING – the Energy Cost Factor (ECF)

The **SAP 2010** rating is related to the energy cost factor by the equations:

if ECF ≥ 3.5, SAP 2009 = 117 – 121 × log10(ECF)……(1)
if ECF < 3.5, SAP 2009 = 100 – 13.95 × ECF…… (2)

The SAP ratings 2005 and 2010, unlike previous versions now takes into account energy for lighting and the effect of thermal bridges, and also takes account of energy generated in the dwelling using technologies like micro-CHP or photovoltaics.

The basic SAP rating scale (1-100) has been set so that SAP 100 is achieved at zero-ECF. It can rise above 100 if the dwelling is a net exporter of energy. The SAP rating is essentially independent of floor area. The SAP rating is rounded to the nearest integer. If the result of the calculation is less than 1 the rating should be quoted as 1.

The idea of having a SAP rating of 100 for something which has a zero cost is a significant improvement on previous versions. However, the fundamental problem of trying to relate performance to energy prices is still a serious limitation in the period of widely fluctuating energy prices. Indeed the calculations according SAP 2005 and SAP 2009 for the same Energy Cost factor give different values as shown in the following Table.

	SAP 2005	SAP 2009
-3	142	139
-2.5	135	132
-2	128	126
-1.5	121	119
-1	114	113
-0.5	107	106
0	100	100
0.5	93	94
1	86	87
1.5	79	81
2	72	74
2.5	65	68
3	58	61
3.5	51	51
4	45	44
4.5	39	38
5	34	32
5.5	30	27
6	25	23
6.5	22	19
7	18	15
7.5	15	11
8	12	8
8.5	9	5
9	6	2
9.5	3	-1
10	1	-4

Table 15 of the SAP 2009 documentation also shows that there are differences in the SAP Value between 2005 and 2009 for different fuel types as shown reproduced in the following table.

It is noteworthy that the SAP Values for home heated with Mains Gas are all down rated, while those heated with LPG or Solid fuel are all rated up.

SAP 2005	SAP 2009 SAP for main heating fuel as:					
	Mains gas	LPG	Oil	Electricity	Solid	Biomass
1	1	10	1	6	12	9
10	9	20	9	16	21	18
20	19	31	19	26	31	28
30	29	41	29	37	41	37
40	39	50	39	46	50	47
50	48	59	50	56	59	56
60	58	68	60	65	68	65
70	67	76	70	74	77	74
80	76	84	80	82	85	83
90	85	92	90	91	93	92
100	94	99	100	99	100	100

2.1.10 The Carbon Index Calculations (which were relevant for 2002 Regulations but no longer).

This section is for historic interest only

The calculation of the Carbon Index was a major step forward and for the first time attempted to assess the true environmental performance of a building.

The stages in computation follow steps (1) – (12) of the Standard Assessment procedure as outlined in section 2.1.8.

The procedure then continued as follows:-

13) From the computed fuel use, determine the total amount of CO_2 emitted by the building.
14) Determine the Carbon Factor (CF) by dividing the total CO_2 emission as follows

CF = CO_2 /(TFA+45) where TFA is total floor area, i.e. it is the carbon emission per modified floor area.

Then determine the Carbon Index (CI) from

CI = 17.7 – 9.0 $\log_{10}$(CF)

The Carbon Index ranges from 10 with a low CO_2 emission to 0 for a high emission.

The last equation is where the complication of a scale going beyond 10 arises (see section 2.1.5.3). If the Carbon Factor (CF) computes to less than 7.17, then it is to be treated as zero.

The use of a scale going from 0 (high carbon emission) to 10 (low carbon emission) also confuses some people (who think a low number is better).

Fig. 2.1.1 shows what the carbon emissions would be for the same house designed to different standards. It can be seen that the emissions have fallen from 70 kg CO_2 per m^2 per year to less than 10.

The 2002 regulations indicated that compliance is achieved with an emission of about 11 kg CO_2 per m^2, corresponding to a carbon index of 8. However, if a true scale were used then both the Elizabeth Fry Building and the ZICER Building would outperform even the theoretical 10 out of 10 building – see Fig. 2.1.2.

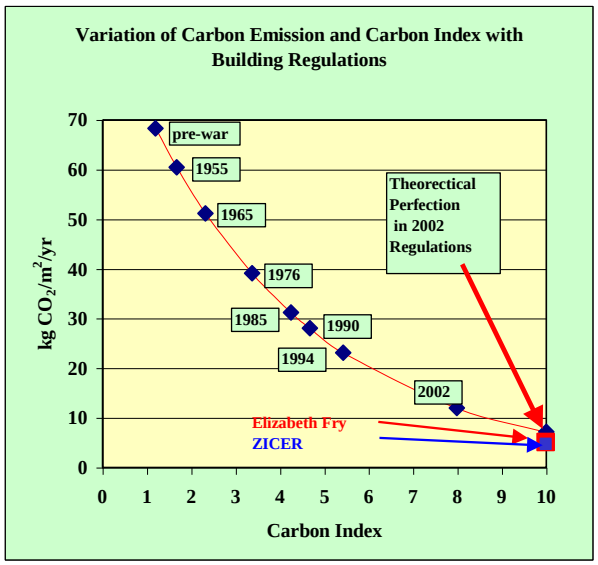


Fig. 2.1.1. Variation in carbon emissions with different Building Standards

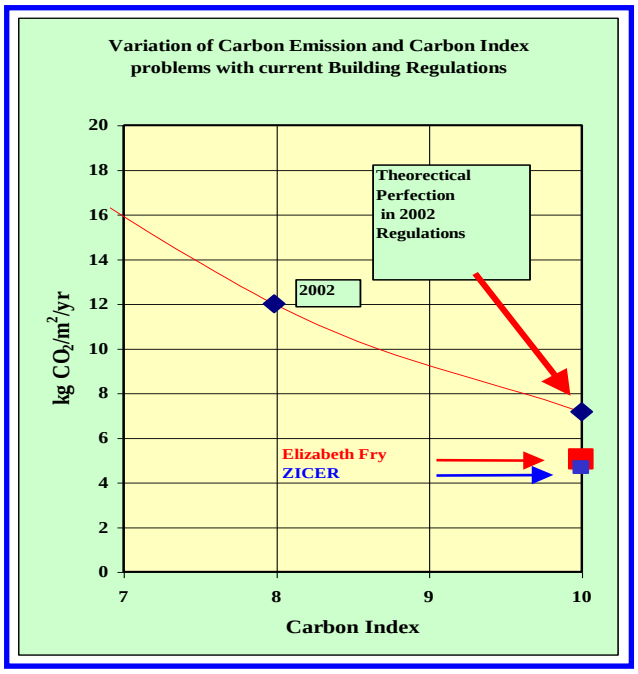


Fig. 2.1.2 Enlargement of part of Fig. 9.1 to show performance of Elizabeth Fry and ZICER Buildings in relationship to Theoretical 10 out of 10 building.

2.1.11 The Target Emission Rate (TER) and the Dwelling Emission Rate (DER) – 2005 and 2010 Regulations

The calculation of the Target Emission rate (**TER**) and Dwelling CO_2 Emission Rate (**DER**) are required to satisfy compliance in the 2005 and 2010 Building Regulations. The **DER** is equal to the CO_2 emissions per unit floor area for space and water heating and lighting, less the emissions saved by energy generation technologies, expressed in kg/m²/year to two decimal places. The **DER** must not exceed the **TER** for compliance to Part L1A of the Building Regulations.

Calculation of the Target Emission Rate (TER - 2010)

The CO_2 emissions are calculated for a notional dwelling of the same size and shape as the actual dwelling and constructed according to the reference values in Appendix R of SAP 2009 (see also last column of Table 2.1.1).

The **TER** is then calculated from the formula:

$$\mathbf{TER_{2010} = (C_h \times FF \times EFA_h + C_l \times EFA_l)} \times (1–0.2)^* (1 – 0.25)$$

Where

C_h is the energy requirements for space heating and hot water including any used in circulating pumps,

C_l is the energy use for lighting

FF is a fuel factor

EFA is the relevant Emission Factor Adjustment and is a ratio of the emission factors used in the 2009 calculations divided by the equivalent ones in the 2005 calculations.

Calculation of the Dwelling Emission Rate (DER - 2010)

The calculation should proceed by following the appropriate section of the SAP worksheet, designed for calculating carbon dioxide emissions for:

a) individual heating systems and community heating without combined heat and power (CHP); or

b) community heating with CHP and waste heat from power stations.

Compliance is achieved if **DER** < **TER**

An Environmental Impact Rating (EI rating) is calculated which is related to the annual CO2 emissions by:

CF = (CO2 emissions)/(TFA + 45)……(3)
if CF >= 28.3 EI rating = 200 – 95 × log10(CF) …..(4)
if CF < 28.3 EI rating = 100 – 1.34 × CF ……(5)

where the CO2 emissions are calculated in box (112) or box (119*) and TFA is the total floor area of the dwelling as in box (5). The figures in brackets relate to boxes in the worksheet for SAP 2005 which may be seen at :

http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/Final_SAP2005_worksheet.pdf

A draft worksheet for SAP 2009 is also now available and this may be found at

http://www2.env.uea.ac.uk/gmmc/energy/energy_links/building_regs/Draft_SAP_2009_worksheet.pdf

The EI rating scale (1-100) has been set so that EI 100 is achieved at zero net emissions. It can rise above 100 if the dwelling is a net exporter of energy. The EI rating is essentially independent of floor area. The EI rating is rounded to the nearest integer. If the result of the calculation is less than 1 the rating should be quoted as 1.

As with the SAP Rating, the arbitrary selection of this non-linear scale is questionable although at least in this case it is not influenced by relative pricing of fuels. Furthermore, unlike the Carbon Index of SAP 2001, there is no truncation of the scale.

There is a small difference between the EI Rating Scale for SAP 2005 from that for SAP 2009. The main difference occurs for homes which are heated electrically where the EI index is down rated slightly

2.1.12 New Building Regulations 2010

Following extension consultation relating to the revision of the Building Regulations in late 2009, new regulations come into force on October 1st 2010. Details of the consulation process may be found at:

http://www.communities.gov.uk/publications/planningandbuilding/partlf2010consultation

A similar consultation on the changes in the Standard Assessment Procedure (SAP 2009) may be found at:

http://www.decc.gov.uk/en/content/cms/consultations/consult_sap/consult_sap.aspx

All the above links will shortly (mid September 2009) appear on the UEA Energy WEBlinks Page

http://www2.env.uea.ac.uk/gmmc/energy/enpoint.htm

2.2 Code for Sustainable Homes

2.2.1 Introduction

The Code for Sustainable Homes is a voluntary standard which came into force on 1st May 2008. The Code not only tackles energy and carbon dioxide issues, but also other relevant aspects such as water use etc as show below.

- Energy and CO_2 Emissions
- Pollution
- Water
- Heath and Wellbeing
- Materials
- Management
- Surface Water Run-off
- Ecology
- Waste

There are six Code Levels 1 – 6 with Code Level 6 being the highest and an aspiration that Code Level 5 will become the norm for all new buildings from about 2015.

In each of the above sections credits are obtained for certain actions. Thus in part of the Energy and CO_2 emission section some credits are awarded depending on how the predicted performance compares with the **TER** as described in section1.6.2. In the Building Regulations 2005, criterion 1 required the Dwelling Emission Rating (**DER**) to be less than the **TER**. In the Code a higher number of credits is obtained the more the **DER** is below the **TER**.

In some credits are gained solely on the basis of the presence or absence of a particular feature – e.g. one gets a credit for having cycle storage.

There are two separate aspects to consider. Firstly there are some of the above categories for which the relevant code level must be achieved for that category, and secondly the number of credits must exceed a given level for a particular code level to be achieved

In the Energy Section achieving a given Code Level requires reaching the following improvements on the **TER** (Fig. 2.1).

Minimum Standards		
Code Level	Category	Minimum Standard
1 (*)	Energy / CO_2 Percentage improvement over **TER** determined in the 2006 Building Regulations (SAP 2005)	10%
2 (**)		18%
3 (***)		25%
4 (****)		44%
5 (*****)		100%
6 (******)		A "zero carbon home" (heating, lighting, hot water and all other energy uses in the home)

Fig. 2.2.1 Improvements on TER which must be achieved to achieve a given code level.

The credits in each category are summed and the total multiplied by a factor for that category (see Fig. 2.2) and then all resulting numbers are added to achieve an aggregate score. The code level achieved is then categorised by the aggregate score achieved.

The Code is defined in 6 levels numbered 1 – 6 with Code 6 being the most demanding.

Though the code is a voluntary standard at present mandatory ratings against the Code came into force from May 2008. This means that while it remains voluntary to design and build a home to meet the standards set out in the Code, regulations will mean that from May 2008 those selling new homes will be required to provide information to any prospective purchaser on the sustainability of the home. Where a home is designed and built to the Code and assessed against it, a Code certificate will be provided. Otherwise, a statement of non assessment (a nil-rated certificate) will be provided.

Total Credits available, Weighting Factors and Points			
Categories of Environmental Impact	Total credits in each category	Weighting factor (% points contribution)	Approximate weighted value of each credit
Category 1: Energy and CO_2 Emissions	29	36.4%	1.26
Category 2: Water	6	9.0%	1.50
Category 3: Materials	24	7.2%	0.30
Category 4: Surface Water Run-off	4	2.2%	0.55
Category 5: Waste	7	6.4%	0.91
Category 6: Pollution	4	2.8%	0.70
Category 7: Health and Wellbeing	12	14.0%	1.17
Category 8: Management	9	10.0%	1.11
Category 9: Ecology	9	12.0%	1.33
Total	–	**100.0%**	–

Fig. 2.2.2 Relative Weightings of the different categories of the code.

In this section only a brief review is given and only those parts of the Code relevant to Energy and Carbon Dioxide emissions are covered. Fig. 2.2.3 Summarises the key aspects of the Energy Section of the Code. The following are key WEB links relating to the Code for Sustainable homes:

- The Code http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/englandwales/codesustainable/
- The Technical Guide: http://www.planningportal.gov.uk/uploads/code_for_sustainable_homes_techguide.pdf

Category 1 – Energy/CO_2

Issue	Measurement Criteria	Points Awarded
Target Emission Rate (TER) as defined by 2006 Building Regulation Standards	Points for percentage improvement over Building Regulations Approved Document L (2006) – Conservation of Fuel & Power; calculated using SAP:2005	**One** of the following Point scores
	10%	1.2
	14%	2.4
	18%	3.5
	22%	4.7
	25%	5.8
	31%	7.0
	37%	8.2
	44%	9.4
	52%	10.5
	60%	11.7
	69%	12.9
	79%	14.0
	89%	15.2
	100%	16.4
	a 'zero carbon home'	17.6
Building fabric	Heat Loss Parameter (HLP)	
	EITHER	EITHER
	≤1.3	1.2
	OR	OR
	≤1.1	2.4
Internal lighting	Where the following percentage of fixed fittings are dedicated energy efficient fittings	
	EITHER	EITHER
	≥40% of fittings	1.2
	OR	OR
	≥75% of fittings	2.4
Other Energy		
Drying space	For providing space and posts, footings and fixings for drying clothes in a secure environment for each unit on the site	1.2

Category 1 – Energy/CO_2 *(continued)*

Issue	Measurement Criteria	Points Awarded
Ecolabelled white goods	EITHER Where fridges, freezers and fridge/freezers have an A+ rating under EU Energy Efficiency Labelling Scheme	EITHER 1.2
	AND OPTIONALLY Where washing machines and dishwashers have an A rating and/or washer driers and tumble driers have a B rating under EU Energy Efficiency Labelling Scheme	AND OPTIONALLY +1.2
	OR Information is provided on purchasing and benefits of efficient white goods, where such goods are not supplied with the new home	OR 1.2
External lighting	Where all space lighting is provided by dedicated energy efficient fittings, taking into account the needs of people who have visual impairments	1.2
	AND OPTIONALLY Where all burglar security lighting is: • A maximum of 150W • Fitted with movement detecting and daylight shut-off devices Where all other security lighting is provided with energy efficient fittings and daylight shut-off devices	AND OPTIONALLY +2.4

Category 1 – Energy/CO_2 *(continued)*

Issue	Measurement Criteria	Points Awarded
Low or Zero Carbon Energy Technologies	EITHER Where at least 10% of total energy demand is supplied from local renewable or low carbon energy sources	EITHER 1.2
	OR Where at least 15% of total energy demand is supplied from local renewable or low carbon energy sources	OR 2.4
Cycle storage	Where provision is made for the safe, weather-proof and secure storage of cycles as follows: • 1 and 2 bedroom dwellings – storage for 1 cycle • 3 bed dwellings – storage for 2 cycles • 4 bed dwellings and larger – storage for 4 cycles	
	EITHER In 50% or more of dwellings in a development	EITHER 1.2
	OR In 95% or more of dwellings in a development	OR 2.4
Home office	For the provision of a space and services which allows the occupants to set up a home office in a quiet room	1.2

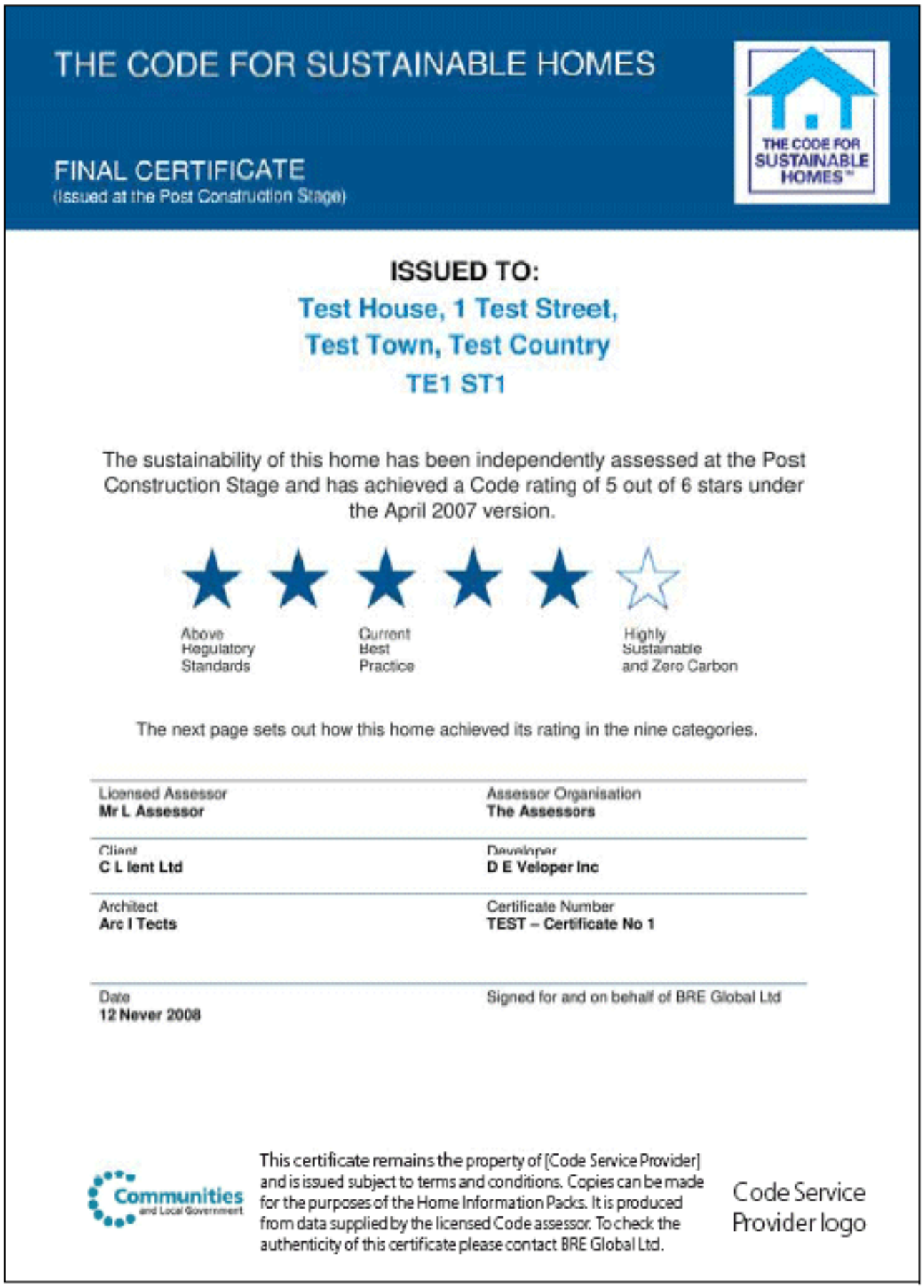
Fig. 2.2.3 Key requirements for gaining credits for Energy Section of Code.

The Target Emission Rating is calculated according to the method in SAP 2005 which has a default assumption of 78% for the efficiency of gas boilers. Thus by installing a modern condensing boiler with an efficiency of 90+%, the energy requirements for Code 1 level are easily met.

However it becomes progressively difficult to go beyond Code Level 2 even with solar panels, and heat pumps and it will be very difficult indeed to achieve Code Level 5 as ventilation heat requirements will then be very significant.

While the Code addresses White Goods etc and effectively give credit for A+ appliances, no credit is give for a house being supplied by "Green Electricity". Nor does electricity supplied by a large wind turbine or other large source unless the community has a Private Wire.

The final certificate is in two parts as shown in Figs.2.2.4 and 2.2.5 whereas Fig. 2.2.6 shows a NIL-Rated Certificate if the developer has not had a Code Evaluation done



THE CODE FOR SUSTAINABLE HOMES

FINAL CERTIFICATE
(Issued at the Post Construction Stage)

THE CODE FOR SUSTAINABLE HOMES™

ISSUED TO:

Test House, 1 Test Street,
Test Town, Test Country
TE1 ST1

The sustainability of this home has been independently assessed at the Post Construction Stage and has achieved a Code rating of 5 out of 6 stars under the April 2007 version.

★ ★ ★ ★ ★ ☆

Above Regulatory Standards

Current Best Practice

Highly Sustainable and Zero Carbon

The next page sets out how this home achieved its rating in the nine categories.

Licensed Assessor **Mr L Assessor**	Assessor Organisation **The Assessors**
Client **C L lent Ltd**	Developer **D E Veloper Inc**
Architect **Arc I Tects**	Certificate Number **TEST – Certificate No 1**
Date **12 Never 2008**	Signed for and on behalf of BRE Global Ltd

Communities and Local Government

This certificate remains the property of [Code Service Provider] and is issued subject to terms and conditions. Copies can be made for the purposes of the Home Information Packs. It is produced from data supplied by the licensed Code assessor. To check the authenticity of this certificate please contact BRE Global Ltd.

Code Service Provider logo

Fig. 2.2.4 The Final Certificate

THE CODE FOR SUSTAINABLE HOMES

FINAL CERTIFICATE

(Issued at the Post Construction Stage)

Certificate Number: TEST – Certificate No 1 **Score: 150**

What Your Code Star Rating Means

Combined Score	36-47	48-56	57-67	68-83	84-89	90-100
Stars	1	2	3	4	5	6

The Code for Sustainable Homes considers the effects on the environment caused by the development and occupation of a home. To achieve a star rating a home must perform better than a new home built to minimum legal standards, and much better than an average existing home.

How this home scored

Category	Percentage of Category Score attained (0 10 20 30 40 50 60 70 80 90 100)	What is covered in the category
Energy	50	Energy efficiency and CO_2 saving measures
Water	25	Internal and external water saving measures
Materials	66	The sourcing and environmental impact of materials used to build the home
Surface Water Run-off	43	Measures to reduce the risk of flooding and surface water run-off, which can pollute rivers
Waste	100	Storage for recyclable waste and compost, and care taken to reduce, reuse and recycle construction materials
Pollution	77	The use of insulation materials and heating systems that do not add to global warming
Health & Wellbeing	16	Provision of good daylight quality, sound insulation, private space, accessibility and adaptability
Management	59	A Home User Guide, designing in security, and reducing the impact of construction
Ecology	37	Protection and enhancement of the ecology of the area and efficient use of building land

Further detailed information regarding The Code for Sustainable Homes can be found at www.communities.gov.uk/thecode

Communities and Local Government

This certificate remains the property of [Code Service Provider] and is issued subject to terms and conditions. Copies can be made for the purposes of the Home Information Packs. It is produced from data supplied by the licensed Code assessor. To check the authenticity of this certificate please contact BRE Global Ltd.

Code Service Provider logo

Fig. 2.2.5 The Rating Certificate showing the performance in each category

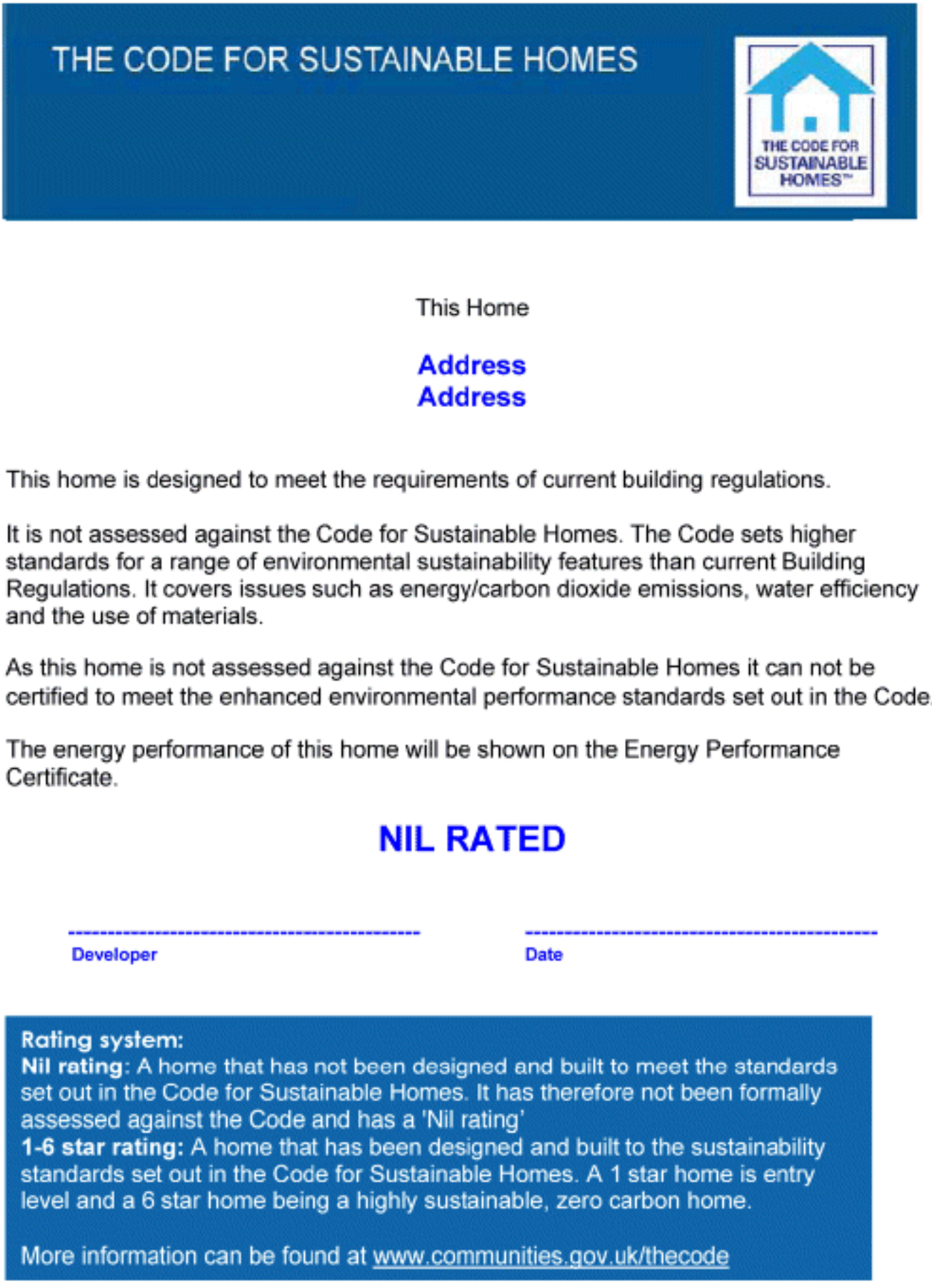
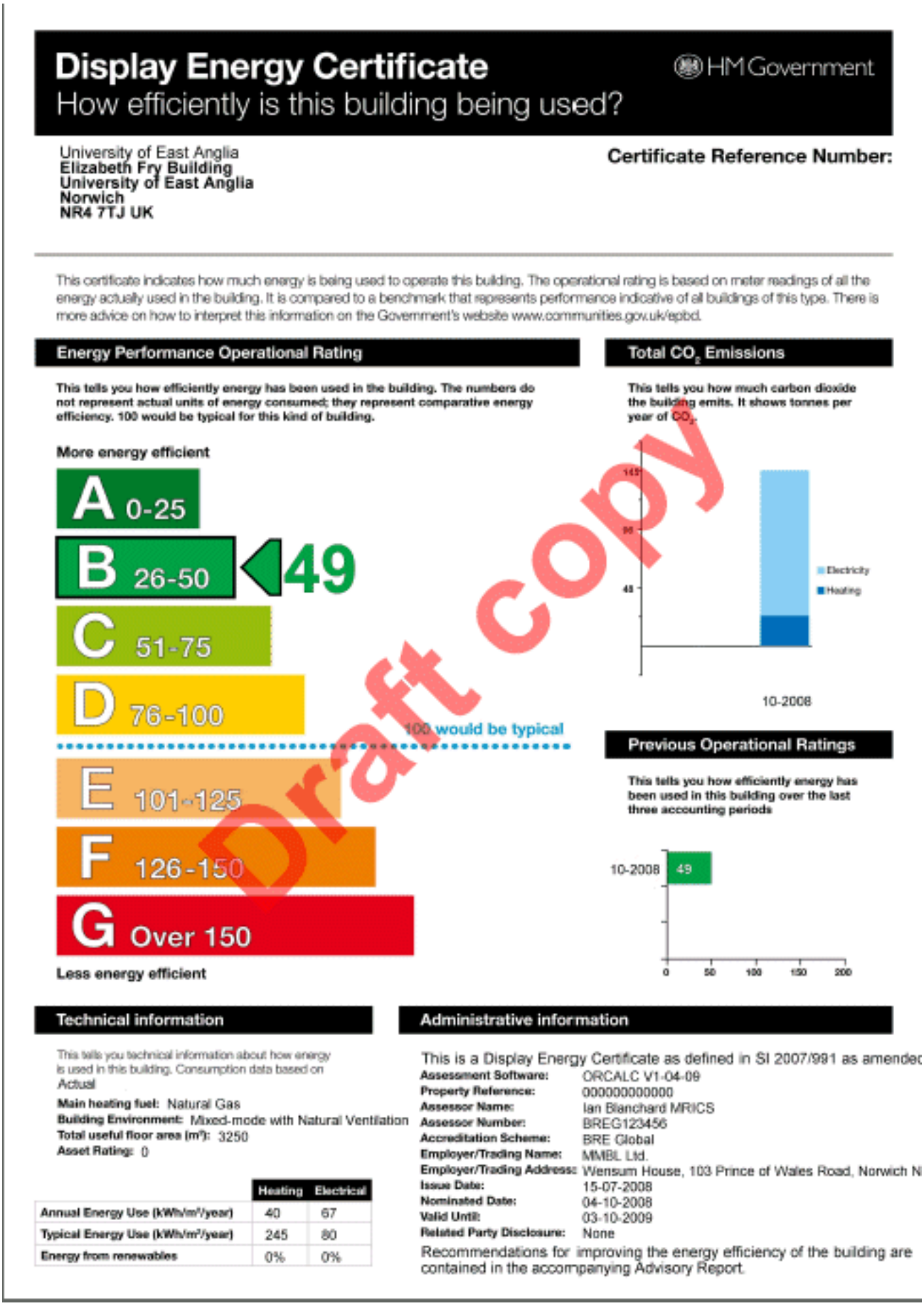


Fig. 2.2.6. A NIL-RATED Certificate which must be displayed if a Code Level Rating has not been evaluated.

2.3 Non Residential Buildings



Display Energy Certificate

How efficiently is this building being used?

HM Government

University of East Anglia
Elizabeth Fry Building
University of East Anglia
Norwich
NR4 7TJ UK

Certificate Reference Number:

This certificate indicates how much energy is being used to operate this building. The operational rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Operational Rating

This tells you how efficiently energy has been used in the building. The numbers do not represent actual units of energy consumed; they represent comparative energy efficiency. 100 would be typical for this kind of building.

More energy efficient

A 0-25
B 26-50 49
C 51-75
D 76-100
100 would be typical
E 101-125
F 126-150
G Over 150

Less energy efficient

Total CO_2 Emissions

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO_2.

Previous Operational Ratings

This tells you how efficiently energy has been used in this building over the last three accounting periods

Technical information

This tells you technical information about how energy is used in this building. Consumption data based on Actual

Main heating fuel: Natural Gas
Building Environment: Mixed-mode with Natural Ventilation
Total useful floor area (m^2): 3250
Asset Rating: 0

	Heating	Electrical
Annual Energy Use (kWh/m^2/year)	40	67
Typical Energy Use (kWh/m^2/year)	245	80
Energy from renewables	0%	0%

Administrative information

This is a Display Energy Certificate as defined in SI 2007/991 as amended

Assessment Software:	ORCALC V1-04-09
Property Reference:	000000000000
Assessor Name:	Ian Blanchard MRICS
Assessor Number:	BREG123456
Accreditation Scheme:	BRE Global
Employer/Trading Name:	MMBL Ltd.
Employer/Trading Address:	Wensum House, 103 Prince of Wales Road, Norwich N
Issue Date:	15-07-2008
Nominated Date:	04-10-2008
Valid Until:	03-10-2009
Related Party Disclosure:	None

Recommendations for improving the energy efficiency of the building are contained in the accompanying Advisory Report.

Fig. 2.3.1 recently Produced Draft Certificate for Elizabeth Fry Building

All commercial buildings will soon have to display an ENERGY PERFORMANCE CERTIFICATE as shown in Fig. 3.1. Initially it was required for very large buildings (>10000m^2 from 6th April 2008), then medium size buildings (>2500 m^2) had the requirement from 1st July 2008, and finally all non-residential buildings must displace a certificate from 1st October 2008.

Separate assessments are being brought in for air-conditioning in buildings from 4th January 2009 for plant > 250 kW, and from 4th January 2011 for plant > 12kW.

One of the first buildings in the medium size category to have such a certificate was the "Elizabeth Fry" Building, but this has raised several questions about the tick-box approach that is used in the methodology. Thus credit is given for specific functions – i.e. one gets credit if you have them but not otherwise. In a building like Elizabeth Fry several issues arose such as :

Elizabeth Fry did not get credit as it does not have thermostatically controlled radiator valves. Such controls are irrelevant as there are no radiators.

Credit is given for having double-glazing, but the system does not include options for the triple/quadruple glazing of Elizabeth Fry and so correct credit is not afforded.

2.4 Indian Building Regulations

Introduction

The Indian Government passed the Energy Conservation Act in 2001 and as part of this the International Institute for Energy Conservation in the USA developed the Energy Code document may be accessed at:

http://www.hareda.gov.in/ECBC.PDF

Saurabh Kumar, Secretary of the Ministry of Power indicated on 18th April 2007, that ECBC 2006 would be implemented shortly in some demonstration areas.

The code has both mandatory and prescriptive elements. With regard to the fabric of the building, the mandatory elements are the the issues associated with windows and air-leakage. In the case of windows, maximum allowable U-Values are specified while mandatory requirements on solar gain overheating are also included.

The prescriptive requirements cover the other fabric components such as the roofs, walls etc, but unlike the UK regulations have different requirements according to the differing climate regimes across India.

The UK has 18 declared zones which are used in Degree-Day calculations, but U-values are the same irrespective of location. Thus a building in the South West of England is likely to have an overall consumption only 75% that of a building in the North of Scotland. The different climate zone used in India are shown in Fig. 2.4.1

EBCB 2006 also differentiates between different classes of non-residential building with different U-Value requirements as shown below. However, as an interim measure less stringent requirements of 0.44 W/m^2 $^oC^{-1}$ were permitted until 31st December 2008.

Table 2.4.1 Variation of U-value of walls with Climate Zone and Building Type

Climate Zone	**Hospitals, Hotels, Call Centers (24-Hour)**	**Other Building Types (Daytime)**
	Maximum U-factor (W/m^2 $^oC^{-1}$)	Maximum U-factor (W/m^2 $^oC^{-1}$)
Composite	0.352	0.352
Hot and Dry	0.369	0.352
Warm and Humid	0.352	0.352
Moderate	0.431	0.397
Cold	0.369	0.352

Based on Table 4.3.2 or ECBC 2006.

Note: The U-value in the UK is 0.35 W/m^2 $^oC^{-1}$

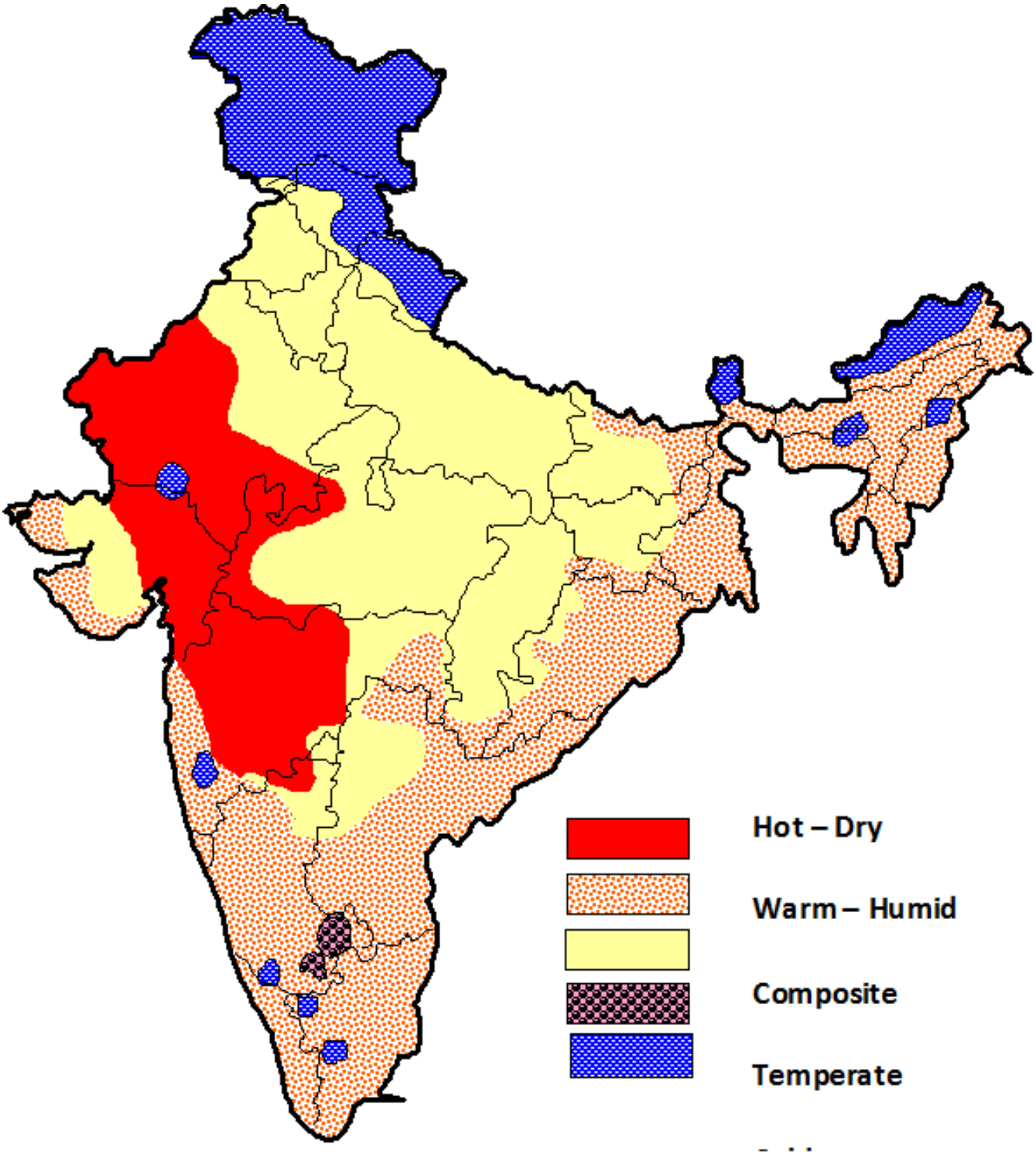


Fig. 2.4.1 Climate Zones in India

2.5 Chinese Building Regulations

Six separate Chinese Building Energy Saving Codes have been issued since 1995. These are:

- Residential Building Energy Saving Design Standards (for New Heating Building Only, JGJ26-95) in 1995.
- Existing Heating Residential Building Energy saving Refurbishment technological Criterion (JGJ129-2000) in 2000.
- Heating Residential Building Energy Saving Assessment Standards (JGJ132-2001) in 2001.
- Building Energy Saving Design Standards in Hot Summer and Cold Winter Zone, (JGJ134-2001) in 2001.
- Building Energy Saving Design Standards in Hot Summer and Warm Winter Zone (JGJ75-2003) in 2003.
- Public Buildings Energy-efficient Design Standards (GB50189-2005) in 2005.

As in India, there are different requirements for the different climate zones in China which are defined as:

- chilly,
- cold,
- hot summer and cold winter,
- hot summer and warm winter,
- mild

The main aim of the latest regulations relating to public buildings is to reduce the energy consumption of such buildings compared to the same size and type of building built to standards which were common in the 1980s.

The standards for indoor temperatures are now set at 20^oC in winter and 25^oC in summer.

The U-value of the external walls for buildings in Beijing is now 0.6 $W/m^2\ ^oC^{-1}$ compared to 1.70 $W/m^2\ ^oC^{-1}$ in the 1980s
In Shanghai the equivalent values are 1.0 $W/m^2\ ^oC^{-1}$ and 2.0 $W/m^2\ ^oC^{-1}$ respectively

The latest standards as with India and UK specify standard for the efficiency of heating and air-conditioning plant.

The latest standard indicates that the improvement in energy consumption by 50% might be achieved as follows.

Item	U-value improvement in envelope structure/fabric	Energy efficiency improvement in heating, air-conditioning and ventilation systems	Other energy efficiency improvement (lighting, etc.)
Energy saving rate	13-25%	16-20%	7-18%

Table 2.5.1 Energy saving rate according to the Chinese national Standards

APPENDIX A1

Treatment of Organisational Changes under the CRC –Energy Efficiency Scheme.

This information was taken from the CRC-Energy Efficiency Scheme User Guide, section 2 and relevant parts of the Appendix A1. See http://www.environment-agency.gov.uk/business/topics/pollution/98263.aspx for the current information on the Scheme. Version was updated on 6th April 2010.

More detail on qualification can be found in guidance issued by the Environment Agency, available at www.environment-agency.gov.uk/crc

2.1 Qualification criteria

Qualification for CRC is based on half hourly electricity supply received during the qualification period. For the introductory phase, this is the 2008 calendar year. All organisations that had at least one half hourly meter settled on the half hourly market in 2008, will be required to do something under the CRC, and inform the Environment Agency.

An organisation (the structure of which is defined on 31 December 2008) qualifies as a full participant in CRC if:

- at any point during the qualification period

it had at least one half hourly meter (HHM) settled on the half hourly market, and

- its 2008 annual electricity supply through all HHMs was at least 6,000 MWh.

Organisations that had at least one HHM settled on the half hourly market, but whose annual energy supply is less than 6,000 MWh do not have to participate in CRC. However, these organisations do have to make an information disclosure. See section 2.3 and guidance issued by the Environment Agency on making an information disclosure, for more information.

About settled half hourly meters (HHMs)

Electricity suppliers use HHMs to calculate your bill. There are four types of metering which can be settled on the half hourly market. These are:

- mandatory HHMs (which are HHMs required to be installed in certain situations under current legislative requirements)
- voluntary HHMs
- half-hourly Light Meters, and
- pseudo HHMs.

2.1.1 Calculating electricity supply

To work out the annual electricity supply which you received (for the second qualification criterion), you need to add up all the electricity supply that was monitored by all types of HHM owned by your 31 December 2008 organisation structure at any point during the year. This includes all remotely read automatic meter reading (AMR) meters, in addition to the settled HHMs listed above.

The administrator has sent a letter to organisations that were supplied with electricity through at least one settled half hourly meter during 2008. This information includes the 2008 electricity supply data for that meter which will help you calculate your total HHM electricity for 2008. If your organisation has not received a qualification letter but you believe you had at least one settled half hourly meter in 2008, please contact the dedicated CRC email helpdesk: crchelp@environment-agency.gov.uk

The basic rule under CRC is that any electricity supply counts as your responsibility if your organisation has an agreement with another party to supply you with electricity, which you receive via a meter for your own use and for which you pay for on the basis of the meter readings.

If you purchase electricity through a third party agent who procures energy services on your behalf and pays the bills, you are responsible as the organisation that contracted the agent.

Landlords and Tenants

In the case of landlords and tenants, energy supply in leased buildings is the responsibility of the customer who has the contract with the energy supplier. This means that if you rent space for your business and you are billed by the supplier, you are responsible for that electricity under CRC. If you are a landlord organisation and you pay the bills, then you are responsible for the electricity use.

A landlord or tenant can never be considered an agent as described above. Government will not allow the transfer of responsibility for energy supply from the landlord to its tenant or vice versa.

Tenants are also obliged to co-operate with their landlords where necessary for the purpose of complying with CRC, for example by providing its landlord with data related to its energy supplies.

2.2 What counts as an organisation?

The rules above are simple to apply to organisations that are single entities. The single entity organisation will be responsible for determining qualification and will be the 'primary member' in CRC.

In general, a public sector entity designated as a 'public authority' under the Freedom of Information (FOI) Act 2000 and the Freedom of Information (FOI(S)) Act (Scotland) 2002 will participate in CRC on the basis of their Qualification criteria individual FOI/FOI(S) listing, or the listing of their organisational type, unless they are legally part of another body, in which case they would participate as part of that parent body.

However, if your organisation is any of the following, specific rules apply:

- part of an organisational group, (e.g. an undertaking)
- a central Government department or related body or agency
- a joint venture/PFI
- a franchisee or franchisor
- a school or local authority
- a university.

If your organisation fits into one of these categories, you should read the appropriate subsection for more information.

Group organisations and subsidiaries

Qualification for CRC is determined according to the organisational structure at the end of the qualification period. For the introductory phase, therefore, qualification is based on the organisational structure on 31 December 2008, meaning organisations will need to aggregate the 2008 half hourly electricity supplies from all the subsidiaries they owned on that date to determine whether a group qualifies.

In the scheme, subsidiary organisations will be grouped together under their highest parent. The scheme will draw on the Companies Act 20061 definitions of parent and subsidiary undertakings to define the relationships within the Group, specifically using the definition of 'Group Undertaking' set out in section 1161(5) of the Act.

Registration and the compliance account must be managed by one member of the group. That person acting for the group will be the primary member and it must be a UK-based organisation. The highest parent will be the default primary member unless the group chooses to nominate another UK-based group member to carry out the administrative requirements of the scheme. The primary member will liaise with the administrator and have access to the registry in order to report emissions for the group and buy, sell and surrender allowances on behalf of the group.

All members of the group are responsible for the group's compliance in the scheme.If the highest parent organisation is based outside the UK, it is required to nominate a UK based group member to act as the primary member and facilitate participation in the scheme on behalf of the group. See the Companies Act 2006 – http://www.berr.gov.uk/bbf/co-act-2006/index.html

Where an organisation has any subsidiaries that would be eligible to participate in their own right were they not part of a group, these large subsidiaries are known as Significant Group

Undertakings (SGUs). Groups with members that are defined as SGUs have some additional administrative requirements. They also have the choice to disaggregate large subsidiaries to participate in CRC separately. Details of this process can be found below.

For each of these SGUs, the primary member must:

- provide separate information on the SGUs half hourly electricity supplies, as part of their group registration
- provide separate information on the SGUs emissions, as part of their group annual report
- notify the administrator in the event of a purchase or sale of one of these subsidiaries.

Disaggregation of Significant Group Undertakings

As part of the registration process, a participant will be able to nominate any SGU that it wishes to disaggregate and participate separately in CRC. The disaggregation could be done at any level of grouping that constitutes an SGU. However, any disaggregation which results in the remainder of the group falling below the qualification threshold of 6,000 MWh will not be permitted.

If the SGU consents to this separate participation, and registers accordingly, it will be treated as a separate participant for the remainder of the phase and will be required to comply with the same obligations as any other full participant. It will be listed as a separate entity in the league table and will receive a separate recycling payment after the end of each annual reporting year. Please refer to the guidance issued by the Environment Agency for details on how to register as a CRC participant.

Each disaggregated SGU will also be required to pay the full fees and charges, as it will be subject to the same audit and identity checks as any other participant in the scheme. See Annex 6 for a full break down of the fees and charges in CRC.

Changes to organisational structure

When an organisation's structure experiences a change involving an SGU, either during a phase, or between the end of the qualification period and the start of the phase – for example, when there is a merger, an acquisition or a sale – there are specific rules on how to account for transfer of responsibility or emissions. See Annex 1 for more information.

Providing this information enables the administrator to account for significant changes when calculating the league table. Though the group will still be listed in the league table and receive the revenue recycling payment, the performance of SGUs will also be made public when the table is published.

This is intended to generate reputational incentives for SGUs to perform well in CRC. Section 4 provides more information on reporting obligations and the league table.

Government departments

Government departments, the Scottish Administration, the Welsh Assembly Government and Northern Ireland Departments must all participate in CRC regardless of whether they meet the qualification threshold or not.

The relevant Secretary of State is the legal entity for a department and its executive agencies (as well as any department-sponsored body that does not have a separate legal identity), and so is responsible for:

- recording and reporting all energy supply from the department
- complying with reporting requirements
- ensuring allowances are purchased
- submitting allowances at the end of the annual reporting year.

Executive non-departmental public bodies and public corporations without majority Government shareholding, which are autonomous and have their own legal status will participate separately, but only if they meet the qualification threshold.

Although Government departments and their devolved equivalents will participate as outlined above by default, they can, if they so wish voluntarily disaggregate any part of their structure including wholly owned or controlled companies, regardless of their size or legal status. The disaggregated body will then be obliged to participate in the scheme on a mandatory basis. In addition, departments and their devolved equivalents will also be able to aggregate with any other public body, apart from other large departments. The power to exercise these disaggregation/aggregation decisions has been given to the Secretary of State, the Treasury, Scottish Ministers, Welsh Ministers and Northern Ireland Departments.

The Secretary of State also has power to require the full participation of local governmental bodies in Wales, such as the Greater London Authority, even where they don't meet the qualification threshold.

Any company which is wholly owned or controlled by a central Government department will participate in CRC with their owning department by default. However, these companies can be disaggregated for separate mandatory participation as outlined above.

Joint ventures and PFI

Ownership of Joint Ventures and Private Finance Initiatives are determined, as with other types of SGUs, by the Companies Act tests. This means a joint owner with a controlling interest in a JV/PFI will take responsibility for that JV/PFI, irrespective of how much of it owns.

Where a JV/PFI is not grouped with a parent according to Companies Act tests, it will be treated in one of two ways:

- where the JV/PFI has a majority owner (>50%), then all of its supplies are aggregated with that of the majority owning organisation.
- where a JV/PFI has no single owner with a stake greater than 50%, the joint venture and all of its subsidiaries are counted as a separate organisation that must assess if it qualifies for the scheme in its own right.

Unincorporated Joint Ventures will be treated the same as all other JVs.

Franchisees and franchisors

Under CRC, franchisors are responsible for the energy supply of all their franchisees – even if the franchisee is legally owned by another CRC organisation (i.e. not the franchisor).

- the franchisor must consider the supplies for all its franchisees to determine whether it meets the qualification criteria
- if the franchisor then meets the first or both of the qualification criteria, it must follow the processes set out in the following sections either to make an information disclosure or participate fully in CRC
- a Franchisee is obliged to provide its franchisor with such reasonable assistance as the franchisor requires, in order to participate in CRC. In particular, the franchisee will have to provide data related to its energy supplies and settled HHM numbers. In most cases, this can be done once a year and the franchisee can request an annual energy statement from its energy suppliers to help compile this data.

If the franchisor itself is a subsidiary, then it needs to follow the guidance for group organisations for reporting its energy supply, including that of its franchisees, to the primary member for its group. See the guidance on group organisations.

If the franchisee is a tenant and the landlord pays the energy bills, the landlord has responsibility for the franchisee's emissions – not the franchisor.

If you are a CRC participant and own a franchisee you must not report the franchisee's emissions as part of your CRC emissions. You must only consider emissions from supplies that you have the contract with the energy supplier or third party energy supplier.

These rules apply to other types of vertical distribution agreement such as distribution or licence agreements.

Schools

In England, Scotland and Wales participating local authorities will be responsible for emissions from all schools maintained by the local authority and any Academies and City Technology Colleges that are geographically located in the area for which the local authority exercises educational functions. The local authority must consider the electricity supplies to these schools when determining whether it meets the qualification criteria.

- if the local authority then qualifies, it must follow the processes set out in the following sections either to make an information disclosure or to participate fully in CRC.

- during the scheme, schools should give reasonable assistance to their local authority and supply data about their energy supply. In most cases, this can be done once a year and the school can request an annual energy statement from its energy suppliers to help compile this data.

- schools must report their energy supply to their local authority following the same rules that participants must comply with. These rules are explained in section 3. In the case of PFI schools, where the PFI company is responsible for the energy supply contract, the energy supply will be attributed to the PFI company. Grant-aided schools in Northern Ireland will be included as part of the Education and Skills Authority (ESA) once it comes into operation. Until then, all grant-aided schools will participate as part of their Education and Library Board.

Private schools

Private schools in Great Britain are not included as part of a local authority's energy supply. Instead, private schools only participate in CRC if they, or their organisational group (including its school(s) as if they were undertakings), pass the CRC qualification threshold of 6,000 MWh / year of half hourly metered electricity use.

Universities

Universities in Scotland, Wales and Northern Ireland will participate in CRC as separate organisations. Only the institutions that meet the qualification threshold have to participate in the scheme.

However, for English Universities, qualification for CRC participation will be assessed against the University and Colleges taken as one group. This will apply to all English Universities

However, for English Universities, qualification for CRC participation will be assessed against the University and Colleges taken as one group. This will apply to all English Universities and their independent colleges and their independent colleges.

Whilst qualification for participation will be assessed against the University and its independent colleges taken as one group, once the group qualifies the colleges will participate individually unless they choose to aggregate either with other colleges of the same university or with the university itself.

Any grouping for participation will only be recognised if it has the agreement of all parties involved. Groupings must be determined at the start of a phase and must be reported as part of the registration process.

Each grouping will be treated as an independent standalone participant and it will be required to pay fees, buy allowances and report separately. The name of the grouping will appear on the league table and the grouping will receive one recycling payment.

From Appendix A1 of the User Guide

Changes in your organisation

It is likely that there will be large scale changes to the organisational structure of many participants during the scheme. For example, an organisation may buy or sell subsidiaries, an entire CRC participant may be purchased by another organisation, or a Government department might restructure. To minimise administrative burdens on both participants and the administrator, CRC will not require you to report on all changes in your organisation.

However, buying or selling a large organisation or subsidiary can have a significant effect on your CRC emissions. CRC therefore takes account of significant organisational changes, referred to as designated changes, as described below.

Selling a Significant Group Undertaking

As described in section 2.2, Significant Group Undertakings (SGUs) are undertakings that would be eligible to participate in CRC in their own right were they not part of another organisation.

They also have the option to disaggregate from their parent organisation to participate in CRC separately, providing that the parent organisation does not fall below the qualification threshold.

As they are large organisations, these undertakings contribute significant amounts of emissions to the total of their participating highest parent organisation – so selling one has a large impact on an organisation's total CRC emissions. In order to account for this, when an organisation sells a SGU:

- the seller must notify the administrator
- the administrator then adjusts the seller's records to remove the SGU and the emissions they are responsible for from the seller's baseline figures, and
- the new baseline figures will be used to calculate the seller's subsequent performance in the scheme and revenue recycling payments. The sale is deemed to have taken effect at the start of the compliance year during which the sale occurs.

Therefore:

- the seller will not report emissions for that subsidiary or participant for that year
- the buyer will report the full year emissions for that subsidiary or participant, and
- revenue recycling payments will be adjusted accordingly. Even if the seller's CRC energy supply is now below the qualification level, the seller must continue to participate in CRC for the rest of the phase.

Buying a Significant Group Undertaking or entire participant

If a CRC participant buys a SGU from another CRC participant, or that participant in its entirety, their baseline figures are also adjusted. The buyer is then responsible for:

- reporting on the emissions of that SGU or entire participant, as part of the buyer's total CRC emissions, from the start of the compliance year in which subsidiary was bought, and
- surrendering sufficient allowances to cover the total CRC emissions.

For example, if participant Organisation Y sells a SGU to Organisation Z on 15 September 2012, midway through a compliance year, Organisation Z is taken to be responsible for the emissions of that subsidiary from April 2012 onwards, the start of that compliance year. In the event of an SGU changing hands more than once during a year, the organisation owning it at the end of that year is the organisation that must report the full year emissions for that subsidiary.

Buying a participant or Significant Group Undertaking as a non-participant

If a non-CRC participant buys an SGU or CRC participant, the buyer will then be obliged to:

- register and participate in CRC for the remainder of the phase, but only on behalf of the organisation it has acquired (i.e. it does not need to calculate its total CRC emissions and must only buy and surrender allowances for the organisation it acquired), and
- assess whether, for the next phase, it qualifies for the scheme as an entire organisation and take action accordingly. When purchasing a CRC participant or principal subsidiary, you should ensure the seller provides the necessary information in order for you to be able to comply with the requirements described above.

Buying and selling smaller subsidiaries and sites

If you buy or sell a small subsidiary that would not qualify for CRC in its own right, you are not required to report it to the administrator, and there is no change to your emissions baseline in these cases. Instead, these smaller organisational changes during each phase are accounted for via the growth metric, described in section 4.7.

Changes to Government organisations

The designated changes described above deal adequately with those structural changes likely to occur in the private sector involving existing CRC participants. These rules do not however account for those situations where new public sector entities are created. This is most likely to be a 'machinery of Government' change, meaning a new central Government department is created.

Changes to government departments often do not involve legally distinct bodies, or equivalents to Significant Group Undertakings, upon which the designated changes rules are based.

Recycling baselines and historic averages will be updated for any machinery of Government or Relevant Decision change rather than restricting updates to public sector equivalents of SGUs.

Under this approach the total baseline figure across central Government will remain constant, with any machinery of Government change/relevant decision resulting in the reapportioning of the total emission figures across the restructured Government estate.

Government departments can also choose to voluntarily disaggregate parts of their structure, regardless of the size of the disaggregated body, for mandatory individual participation in the scheme. All parts so disaggregated will remain within the CRC.

This power of disaggregation is referred to as the Relevant Decision provision and in practice operates in a similar way to the disaggregation of Significant Group Undertakings in the private sector.

APPENDIX A2

Climatic Change Agreements and the Carbon Reduction Commitment. Appendix A2 of the User Guide.

CCAs and CRC

CRC has been designed to minimise policy overlaps with Climate Change Agreements. As a general rule, any emissions across your whole organisation which are already covered by CCAs (or EU ETS) do not ultimately need to be included in your CRC emissions. If a significant proportion of your organisation's emissions are covered by a CCA, you may be exempt from CRC altogether.

CCA exemptions from CRC

There are three circumstances when an organisation can be exempt from CRC due to its emissions being covered by a Climate Change Agreement.

1. General CCA exemption

If you are a single entity organisation which has a CCA that covers over 25% of its relevant emissions, you will be fully exempt from CRC for that entire phase. This exemption calculation applies to all your energy supply emissions, not just half hourly electricity, so you will therefore need to calculate your CRC emissions. If for any reason your organisation ceases to be covered by that CCA, you must participate in CRC from the beginning of the next compliance year.

2. CCA member exemption

If you are a group and any member of your organisational group has more than 25% of its CRC emissions covered by a CCA, that

member (but not its subsidiaries, if it has any) is exempt from CRC. This means that all its energy supply emissions of that member will not be included in the scheme, but the remainder of the group will still have to participate in CRC.

If for any reason the member ceases to be covered by that CCA, its emissions will then have to be included in CRC as part of the organisation's total from the beginning of the next compliance year.

3. Group CCA exemption

If, after deducting the electricity supplies through qualifying meters from group members which have a member exemption, the remaining parts of your organisation have less than 1,000 MWh of qualifying electricity supplies remaining in CRC, then you qualify for a group CCA exemption and your entire organisation will be exempt from CRC. If any part of your organisation is no longer covered by a CCA, its emissions will need to be included in your organisation's CRC emissions. If these then exceed 1,000 MWh then you will lose your Group CCA exemption and you will have to participate in CRC from the beginning of the next compliance year.

If any of the exemptions above apply in your case, you must:

- register as a participant (see section 2.4), and
- disclose (i) the total amount of half hourly electricity supplied to the group as a whole (ii) the amount of half hourly electricity remaining after half hourly electricity used by any exempt group member has been subtracted
- compile and maintain an evidence pack as appropriate (see section 3.6), and
- participate in CRC for all parts of your organisation not exempted in the case of the CCA member exemption.

If at any time your CCA ceases or changes, you must inform the administrator. You will then be required to participate in the scheme from the beginning of the next compliance year.

Reporting other CCA covered emissions

Even if your CCA coverage does not qualify you for an exemption, organisations will not have to report annually or buy allowances for any emissions that are covered by a CCA.

However, because emissions covered by CCAs or EU ETS contribute to ensuring that 90% of all your total footprint emissions are regulated, you do need to include details of them in your footprint report. You then exclude them when working out your CRC emissions (see sections 3.2 and 3.3).

APPENDIX A3

CRC Arrangements for those sites which generate and export electricity.

This is a copy of CRC Energy Efficiency Scheme: Electricity Generation A3.

Annex 3: Treatment of electricity generation in CRC

If your organisation operates an electricity generation process in which the input fuel is covered by the CRC allowances you may be entitled to claim an electricity generating credit under CRC for the amount of electricity you generate and supply – irrespective of whether supplied to an external third party or within your organisation ('self-supply'). In addition you may be able to claim electricity generating credits where electricity is generated from renewable sources and no ROCs or FITs are claimed.Any electricity credits that you are entitled to can be subtracted from your CRC emissions – meaning you have to buy fewer allowances. You will not be able to claim such credits if the installation is:

- a large hydroelectric plant that is exempt from the Renewables Obligation
- a nuclear power station
- a generation facility covered by EU ETS, or
- where ROCs or FITs are issued.

You will also not be able to claim credits for electricity generated and used within your organisation for the direct purpose of electricity generation, transmission or distribution. However, electricity supplied for such purposes is not deemed to be a (self) supply under CRC and you will therefore not be required to report it or surrender CRC allowances.

The CRC is focussed on increasing energy efficiency, and therefore includes all supplies of electricity, including those made within an organisation ('self-supply'). However, to ensure that small CHP plants are not disincentivised under CRC we have included this provision which gives compensatory credit for electricity generated. However, organisations with the facilities listed above would be able to gain a disproportionate advantage in the scheme.

In these cases, the large number of credits they could accumulate without purchase of CRC allowances would enable them to cancel out energy supplies across the organisation and remove the incentive to improve energy efficiency, which would be counter to the main purpose of the scheme.

How electricity credits work

1. All electricity credits refer to electricity generated over the course of a particular compliance year and can only be claimed in the compliance year in which the electricity was generated.
2. It is up to you to work out how many electricity credits you are entitled to during the footprint year, by monitoring the amount of electricity you generate and supply to third parties or within your organisation. The value of these credits is calculated using the grid average emissions factor. You must report data on the sources and value of electricity credits in your footprint report.
3. Every year in your annual report, you should state whether or not electricity generated credits applies to you and the amount of generated and supplied electricity.
4. If over the course of a year your organisation accrues more credits than your organisation's total energy supplies, then your energy supply should be reported as 'zero'. You cannot report a negative figure for energy supplies.

Combined Heat and Power

Under CRC, organisations generating electricity using Combined Heat and Power (CHP) are generally treated like any other heat or electricity production. Electricity credits can be claimed for electricity exported to other users or to the grid, or where they are supplied to the same organisation (All supplies, including those within the same organisation will require CRC allowances). The electricity grid average emission factor is used to calculate the credits.

- If you operate a CHP plant, you must report the primary fuel input to the plant as part of your organisation's energy supply under CRC. However, your use of heat from the plant would not need to be reported. You will have to report your use of electricity according to the general supply and self-supply rules. You will be eligible to claim electricity generating credits for the electricity output of the CHP plant supplied according to the supply and self-supply rules – as long as ROCs/FITs are not being claimed or the CHP plant is not an EU ETS installation.
- All imports and exports of heat from a CHP plant are counted as having zero emissions in CRC. You therefore cannot claim credits for any heat exported from CHP generation.
- If your CHP plant is covered by the EU ETS, it will be treated in line with other EU ETS installations as described on the previous page.

Renewables

In line with the general principles of the CRC to drive energy efficiency, all electricity consumed is reported at grid average (subject to being either a core supply, self supply, or included on the residual measurement list).. As outlined above, a Renewables Obligation Certificate (ROC) is issued or a Feed In Tariff (FIT) is claimed you will not be eligible for electricity generating credits.

However, if you generate electricity from renewables without claiming ROCs or FITs you can claim an electricity credit at the grid average emissions rate which will effectively work as an offset against your organisation's reportable emissions. This is irrespective of whether the renewably generated electricity is used to self-supply or is exported to a third party.

Government is aware that organisations may want to claim credit for their renewable generation. Therefore, data on an organisation's on-site renewable generation which is consumed on site will be published alongside the CRC league table. However, this will not be connected to the revenue recycling mechanism. To enable this you will also have to report on your onsite generation and consumption.

Energy from Waste

In line with the general reporting practices proposed for CRC, where waste is used as an input fuel into an energy generation process, a participant will need to report the quantity of waste used, using the waste emissions factor listed in the regulations.

- If you generate electricity from waste to use onsite, you will need to report this under CRC, according to general 'self-supply' rules.
- You may be able to claim an electricity credit, both for the exported electricity and that used in your organisation.
- If waste is the primary input fuel in a CHP plant, you must report the waste input in the same way as for other electricity generation processes.
- If ROCs are issued for your energy from waste plant this will be treated in line with the treatment of renewables where ROCs are claimed as outlined above. You may not claim electricity credits for this electricity.

APPENDIX A4

CRC – Energy Efficiency Scheme: Exclusions

This is a copy of CRC Energy Efficiency Scheme User Guide Section A4.

Exclusions

As set out in section 3, energy supplied to your organisation in certain specified activities does not count as part of your CRC emissions. The excluded activities are:

- domestic accommodation
- transport, and
- supplies which you do not consume but provide to another party, also do not count towards your CRC emissions (except where this concerns your tenants).

Domestic accommodation

Energy used for domestic purposes will be excluded from CRC, irrespective of the supply arrangements, unless the accommodation is provided for any of the following purposes:

- Education
- Employment
- Religion
- Recreation
- Medical Care

Accommodation on residential parks and holiday parks, including tents, will be classified as domestic accommodation and will therefore not be included in CRC. Most forms of emergency accommodation provided by a Local Authority will also be excluded, however, this exclusion will not be applicable to Hotels or B&Bs.

Activity	Examples of accommodation that will be included within CRC are:
Education	University halls of residence, boarding schools
Employment	Police section houses, armed forces accommodation
Religion	Monasteries, Nunneries and other similar religious establishments
Recreation	Hotels and Bed and Breakfasts
Medical Care	Residential care homes, Nursing homes and Hospitals

Domestic Exclusion: Qualification and Reporting

Energy supplied to buildings classified as domestic accommodation will not contribute to an organisation's qualification or form part of a Participant's footprint subject to the organisations decision whether to include supplies from communal areas in mixed use buildings. All half hourly electricity used for domestic accommodation must be deducted when assessing qualification. If an organisation's remaining supplies fall below the qualification threshold of 6,000 MWh, it will not qualify for CRC. Participating organisations will not be required to report energy supplies used for domestic accommodation in footprint reports or annual reports.

Mixed use buildings

In mixed use buildings, which are used for a combination of both domestic, civic and corporate purposes, participants must identify and deduct the energy supplies associated with domestic accommodation when determining qualification and reporting their emissions to comply with the scheme. This should be done through sub-metering or appropriate approximation techniques. Participants must keep a record of this information in their evidence packs. The appropriate technique for this estimate is a pro rata comparison. Organisations should use a pro rata comparison. Actual meter readings should be used for a period to arrive at a daily supply rate for the building and evidence should be gathered for all the units and appliances that are supplied by energy for CRC (i.e. non-domestic) purposes.

Communal areas in mixed use buildings

Any energy supplied to communal areas in a building used solely for domestic accommodation must always be excluded from CRC. However, where there are communal areas in mixed use buildings, discretion will be given to the organisation to decide whether these areas are treated as part of their civic or domestic estate. Organisations must decide how they want to treat these communal areas when they are calculating their qualifying electricity. This decision must then be applied for the entire phase.

Treatment of CHP servicing domestic accommodation

The domestic exclusion must be applied to CHP and District Heating Schemes which service domestic accommodation. Participants must report and purchase allowances to cover the percentage of input fuel used to generate the energy provided to their non-domestic estate.

Transport

Energy used for the purpose of transport is excluded from CRC. Transport is defined as energy used to power (not only for propulsion):

- a road-going vehicle (which is licensed under the 1994 Vehicle Excise and Registration Act or exempt from the requirement to obtain a licence under that Act)
- a vessel (defined as any boat or ship which is self-propelled and operates in or under water)
- an aircraft (defined as a self-propelled machine that can move through air other than against the earth's surface), and
- a train and related network services (as defined with the same meaning of the 1993 Railways Act).

Energy used for equipment such as lifts, conveyor belts and other onsite mechanisms will be included in CRC. Subject to the definition of transport (outlined above) some forklifts, drill rigs, non-road going mobile or floating cranes and excavators may be included in CRC.

Energy supplied to an organisation for the purposes of transport (as defined above) should not be included as part of an organisation's qualifying electricity or form part of a participant's footprint. However, where an organisation uses half hourly electricity for transport and there is no sub-metering in place, the organisation will be able to decide at the point of registration if they wish to opt in that particular supply. This decision will apply for the rest of the phase and evidence must be recorded in the organisation's evidence pack.

Unconsumed supplies

If you purchase fuel or energy for the purpose of supplying or delivering to a third party (ie not for your own consumption) then such fuel/energy is excluded from your CRC emissions. Responsibility for the CRC emissions would lie with the third party supplied with the fuel/energy – the exception being those instances where a landlord supplies energy to its tenants, where the responsibility for energy supply remains with the landlord organisation.