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Analysis of Display Energy Certificates 2008 – 10

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Analysis of Display Energy Certificates 2008–10

Display Energy Certificates (DEC) are mandatory for public buildings greater than 500m² and must be undertaken annually. This information paper provides a summary of an analysis undertaken to obtain kgCO₂e/m² values shown in Figure 2.7 of Chapter 2 of the book.

1. OBTAINING THE DATA

Display Energy Certificates (DEC) are lodged in an on-line database at www.ndepcregister.com. Access to the full database is not made publically available. A pdf of the DEC for an individual building can be downloaded from the site provided you know the 20 digit reference number for the certificate.

In March 2011, the Centre for Sustainable Energy, using a Freedom of Information request, obtained the dataset for all ratings undertaken in 2008, 2009 and 2010, and published these in excel spreadsheet format.¹ The dataset includes the address, floorspace, heat and power consumption, carbon emissions, and energy efficiency rating of over 40,000 sites, but unfortunately omitted the column identifying the buildings' type.

2. ANALYSIS OF ALL BUILDINGS 2008 TO 2010

Table 1 shows the number of ratings, the total CO₂ emissions and the building area for each year by rating level for all buildings. The median and average rating scores, CO₂ emissions and floor areas are also shown. This suggests that, in general, the benchmarks established for DEC are correct for public sector buildings (i.e. the median and average rating scores are close to 100). There are some concerns with some of the A rated buildings – a spot review shows many of the buildings have almost zero energy consumption, suggesting they are probably empty, not being used intensively, or the energy data has been entered incorrectly. Figure 1 shows that the distribution of ratings in the first three years has not varied significantly.

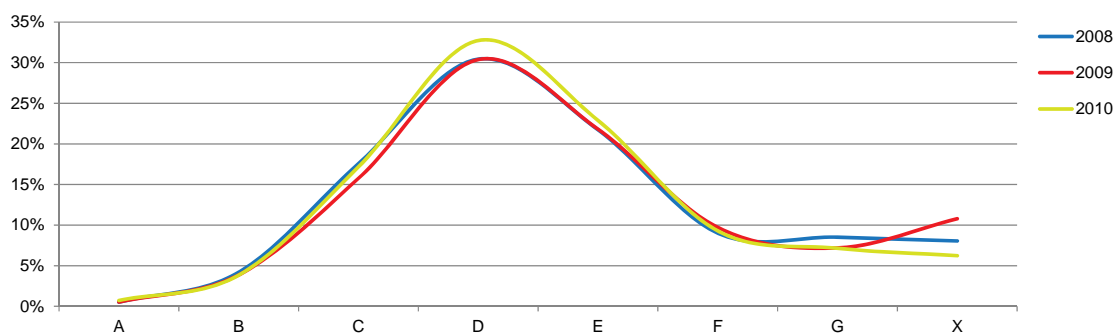


Fig 1 Distribution of DEC ratings for all building types 2008 to 2010

	No. of ratings			Total tCO ₂			Area of buildings (,000 m ²)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
A	71	140	180	6,140	10,104	10,789	316	507	730
B	575	1,033	963	112,719	166,831	166,329	2,340	3,453	3,134
C	2,414	4,209	4,311	755,915	947,010	872,834	11,000	15,465	14,029
D	4,184	8,128	8,221	2,060,965	1,985,139	1,959,018	22,618	27,700	26,483
E	2,988	5,837	5,749	2,739,389	1,946,622	2,015,928	22,181	21,264	20,847
F	1,240	2,598	2,332	1,306,950	1,249,791	1,113,573	8,946	10,736	9,158
G	1,170	1,923	1,796	1,451,330	1,586,786	1,486,891	7,561	8,687	7,726
X *	1,106	2,885	1,566	755,418	1,432,894	167,684	4,474	10,080	4,451
Total	13,748	26,753	25,118	9,188,826	9,325,177	7,793,046	79,436	97,892	86,558
<i>Total (excl. X)</i>	12,642	23,868	23,552	8,433,408	7,892,283	7,625,362			
Median	98	100	97				2,306	1,966	1,911
Average	103	103	101	667	331	324	5,778	3,659	3,446

* The DEC database includes default ratings. This is where a public building needed a DEC but didn't have the energy consumption information and so a default G rated DEC was issued. To avoid distorting the analysis these default ratings are separated out as X ratings in this table and are not included in the median and average calculations.

Table 1 Summary of DEC ratings for all building types 2008 to 2010

3. OFFICES 2008 TO 2010

Unfortunately, the published dataset did not provide a reference for the building type. In this analysis, offices were identified as buildings with an electricity benchmark between 80 and 120 kWh/m² and a thermal benchmark less than 150 kWh/m². The results of this crude filter are shown in Table 2. This identified 3,054 'offices' in the dataset for 2009 which compares reasonably to a more rigorous analysis by CIBSE (Oct 08 to Feb10) which identified 3,230 offices.² Using the same filter there were only 2,311 offices in the 2010 dataset. The calculation of the median ratings for 2009 differs from the CIBSE analysis, although the median in 2010 is very similar, showing a value close to the rating scale median of 100.

Figure 2 indicates that the distribution of ratings for offices has improved, with more buildings achieving C, D and E ratings, and a sharp reduction in default (X) rated buildings. The curves have a kick in the tail, with many more offices having G ratings compared to the distribution for all building types in Figure 1.

	No. of ratings				Total tCO ₂				Area of buildings (,000 m ²)		
	2008	2009	2010		2008	2009	2010		2008	2009	2010
A	5	15	14		233	482	615		22	57	39
B	54	87	88		6,797	7,968	8,137		212	249	233
C	271	445	434		50,961	85,919	74,663		974	1,635	1,404
D	363	705	612		121,942	191,352	175,321		1,730	2,699	2,442
E	318	489	474		139,099	213,750	198,212		1,547	2,359	2,152
F	197	316	269		145,245	177,846	173,817		1,246	1,591	1,520
G	321	398	325		356,048	369,568	275,012		2,053	2,162	1,610
X	265	599	95		144,937	267,980	25,487		960	1,699	223
Total	1,794	3,054	2,311		965,262	1,314,865	931,264		8,743	12,452	9,623
<i>Total (excl. X)</i>	<i>1,529</i>	<i>2,455</i>	<i>2,216</i>		<i>820,325</i>	<i>1,046,885</i>	<i>905,777</i>				
Median	116	113	101								
Average	120	113	110		537	426	409				

Table 2 Summary of DEC ratings for ‘offices’ 2008 to 2010

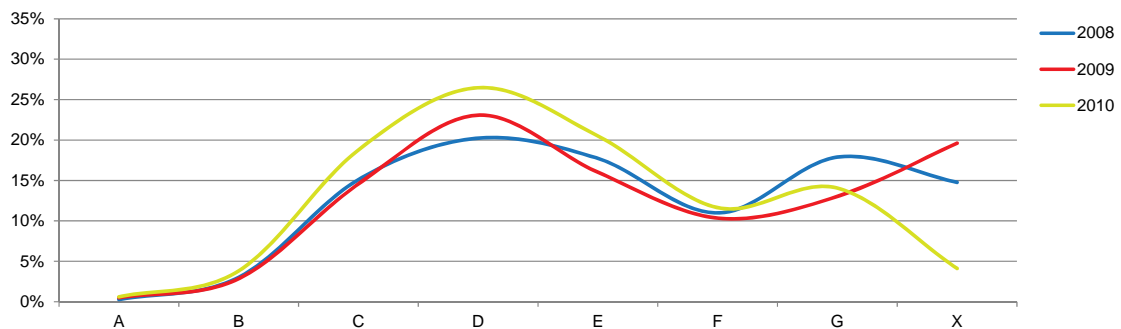


Fig 2 Distribution of DEC ratings for ‘offices’ 2008 to 2010

4. RATINGS BY HVAC TYPE IN 2010

To better understand the type of heating, ventilation and air conditioning (HVAC) services provided in the buildings a more detailed analysis of the 2010 dataset was undertaken. DEC's have five categories for these:

- Heating and natural ventilation.
- Heating and mechanical ventilation.
- Mixed-mode with natural ventilation.
- Mixed-mode with mechanical ventilation.
- Air conditioning.

Table 3 shows the types of services in all buildings and in offices, and the average rating score for each. The difference between naturally ventilated buildings and air conditioned buildings is quite clear. It is also worth noting that the majority of buildings rated do not have air conditioning (4% in all building types) but 16% of rated offices do. As more commercial offices are rated in the future, the median benchmark used in DEC's for offices is likely to shift up as these buildings tend to have air conditioning.

	No. of ratings in 2010		Average rating score		'Offices' * kgCO ₂ e/m ²	No. of 'office' ratings
	All buildings	'Offices'	All buildings	'Offices'		
Heating and natural ventilation	75%	59%	98	99	80	1,367
Mixed-mode with natural ventilation	5%	7%	103	106	86	167
Heating and mechanical ventilation	11%	12%	103	117	95	266
Mixed-mode with mechanical ventilation	5%	7%	111	133	107	152
Air conditioning	4%	16%	125	138	112	359
Average (total)			101	110	89	(2,311)

* Estimated by multiplying the 'office' rating score by 81 kgCO₂e/m². These values are used in Figure 2.7 of Chapter 2 of the book.

Table 3 DEC ratings in 2010 by type of HVAC system

The data used to produce Figure C.2 in Appendix C is shown in Table 4.

	Air conditioning	Mixed-mode with mechanical ventilation	Heating and mechanical ventilation	Mixed-mode with natural ventilation	Heating and natural ventilation	TOTAL	
A	1	0	2	3	8	14	1%
B	6	3	6	8	65	88	4%
C	29	14	31	27	333	434	19%
D	61	33	60	53	405	612	26%
E	73	45	66	30	260	474	21%
F	66	25	50	10	118	269	12%
G	108	26	40	30	121	325	14%
X	15	6	11	6	57	95	4%
TOTAL	359	152	266	167	1,367	2,311	
	16%	7%	12%	7%	59%		

Table 4 Number of DEC ratings by service type for offices in 2010

The solitary A rated air conditioned ‘office’ found during this analysis was the Penweather’s Centre in Truro, a 6,000m² building with a rating score of 25, an annual electricity consumption of 14 kWh/m², and gas consumption of 61 kWh/m². Closer inspection reveals it to be an education centre with limited hours of operation. There is a story behind every rating. The purpose of energy ratings is to encourage you to look beyond the label, to find out why the building performs as it does, good or bad.

A big challenge with rating systems like DECs is balancing the desire to make them quick and simple, so that lots of buildings can be rated inexpensively each year, with having enough rigour (and therefore increased certification cost) to prevent empty or infrequently used buildings obtaining flattering energy ratings.

Notes

All websites were accessed on 15 June 2013 unless noted otherwise.

1. www.cse.org.uk/resources/open-data/display-energy-certificate-data
2. The CIBSE Energy Benchmarking Group was given access to the 45,000 DECs lodged between October 2008 and February 2010. After filtering the data for implausible floor areas or ratings, the group ended up with 29,310 DEC records, of which 15,335 (52%) were schools and 3,230 (11%) were offices. The median DEC score for offices was 100 and for schools was 98. Only 153 buildings (< 0.5%) made use of ‘seperables’ to improve the rating. Reference: CIBSE Journal, May 2011

The inevitable legal bit

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