

What is the impact of Display Energy Certificates?

Introduction

Display Energy Certificates (DECs) were introduced to the UK in 2008 following the EU Energy Performance of Buildings Directive, which required public sector buildings over 1,000m² and that are visited by the public to have an energy assessment. They are required to display their energy rating publically which is updated on an annual basis. Each certificate contains information on actual building energy use and emissions, as well as an Operational Rating (OR) based comparison of actual energy use and emissions with a benchmark for the type of building. This is summarized using an A to G letter rating, where A is the most efficient.

Using DEC administrative data from the Landmark Register, the Department of Energy & Climate Change has produced analysis to help assess how the OR and energy consumption have changed in buildings since the introduction of a DEC. To help gauge the impact that DECs may have had, the energy performance of public sector offices with a DEC has also been compared to that of typical private sector offices over 1,000m², which do not have DEC's, using the National Energy Efficiency Data framework (NEED)¹.

Summary of findings

This analysis suggests that overall Operational Ratings and energy consumption have fallen for public sector buildings with Display Energy Certificates. The improvement has been greater for buildings which were initially poor performers compared to the benchmark, in comparison to intermediate or high performers. Comparing private sector offices to public sector offices with DECs provides tentative evidence to suggest that DECs in particular have had a slight impact on the energy performance of a property.

Data used for analysis

DEC administrative data has been used for this analysis, containing all DECs logged between 2008 and December 2012. This equates to about 138,000 DECs logged on an estimated 48,000 unique premises.^{2,3}

Table 1 shows that the largest group of properties that have a DEC are classed as schools (43 per cent). Offices account for 12 per cent and universities 7 per cent. All other individual categories account for less than 5 per cent of the sample.

¹ NEED <https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/national-energy-efficiency-data-need-framework>

² The administrative data is at DEC level and is aggregated to premise level through address matching, which involves some scope for failing to match all DECs on the same property.

³ The data set was filtered to exclude unrealistic values so analysis only includes ORs between 0 and 500 and cases where year on year changes in OR are less than a factor of 10.

Table 1: Premises with DEC by type

Type of property	Percentage
Schools	43%
Offices	12%
Universities	7%
Other	38%
TOTAL	100%

Trend in Operational Rating

An Operational Rating (OR) is a numerical indicator of the annual CO₂ emissions of a building. The actual building emissions are compared to the median emissions for one of 29 benchmarking categories.⁴ The median standard is the benchmark and it is given an OR of 100. The rating takes account of building size, mixed usage, local heating degree-days and extended hours of use. It does not take into account building occupancy or the presence of equipment (such as air conditioning).

If the building were given an OR of 200, this would indicate that the building has twice the emissions of the benchmark, whereas if the building were given an operational rating of 50, this would indicate that the building has half the level of emissions.

A change in the level of the OR could occur for many different reasons, including a change in energy demand of the premise, an increase in energy efficiency or the uptake of renewable energy.

Chart 1 shows the distribution of initial ORs with actual median 99, lower quartile 79 and upper quartile 126. The tails show that 5 per cent of buildings have double the median OR and about 5 per cent less than half.

⁴ <http://www.bartlett.ucl.ac.uk/energy/news/documents/ei-news-170511-cibse-benchmarking.pdf>

Chart 1: Distribution in Operational Rating of initial DEC

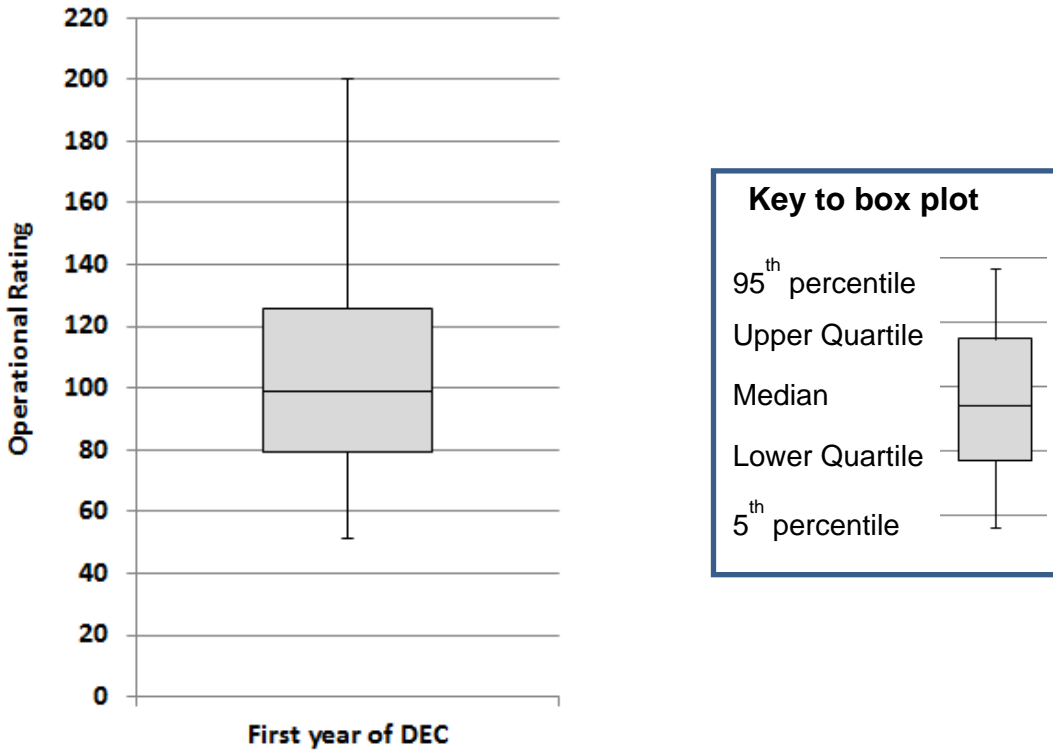
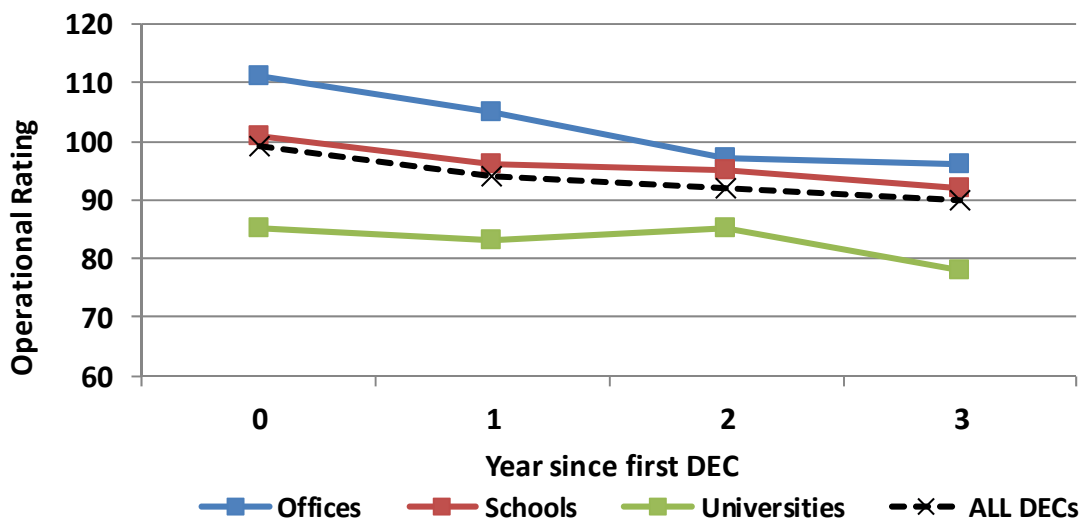


Chart 2 shows the trend in median OR. Overall, this fell by 9 per cent over the course of three years. Schools and universities fell by 9 per cent and 8 per cent respectively while the OR for offices fell by 14 per cent.

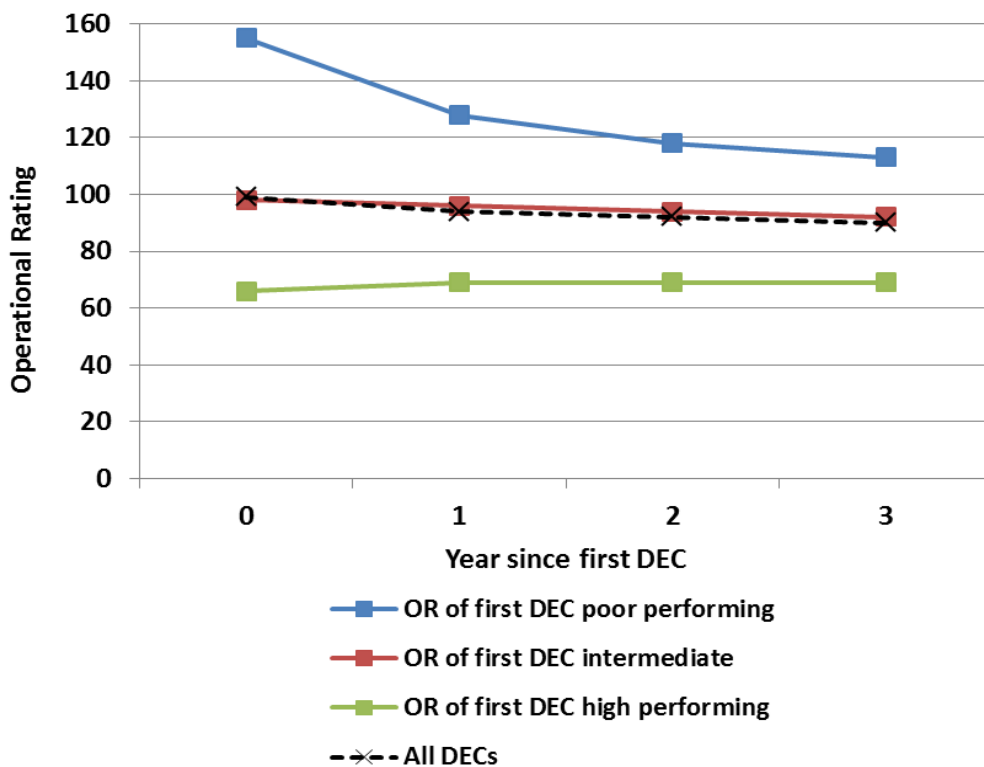
Chart 2: Trend in OR – all DEC



To explore this further, chart 3 splits the data for DEC for all building types depending on whether the initial OR was poor (over 120), intermediate (80 to 120) or high performing (under 80).

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Chart 3: Trend in median OR based on performance of first DEC



To understand the change over time, chart 3 shows how DEC ORs have changed since their initial assessment over 3 subsequent assessments. This trend in OR differs according to the initial OR value in the first DEC. This split reveals that initially poor performing properties improved their OR significantly with the median OR falling by 27 per cent over 3 years whereas initially intermediate properties showed relatively less improvement while well performing DEC's saw a slight increase in their median OR.

The sample size for this analysis decreases over time such that just over a quarter of records can be analysed in year 3. The first year a DEC was introduced is defined as year 0. Table 2 shows the sample size for the number of premises broken down into these subsectors. There are a number of reasons that contribute to the loss of records. These include our ability to match DEC renewals if the address is recorded differently, buildings no longer requiring a DEC not renewing, and renewal outside the window set for the analysis (e.g. early renewal). The data was filtered to only include properties that a repeated DEC can be matched. To capture these repeated DEC's, a window of plus or minus 10 weeks from the anniversary was used to identify these.

The reductions in sample sizes are approximately the same across all these subsectors.

Table 2: Number of premises by category of first DEC

	Poor	Intermediate	Good	Total
Initial records	13,620	21,540	12,120	47,270
Year 0	100%	100%	100%	100%
Year 1	41%	47%	45%	45%
Year 2	34%	37%	37%	36%
Year 3	26%	26%	26%	26%

Trend in Consumption

DECs record the energy consumption for electricity and thermal fuels at the time that the DEC was logged. The analysis and findings are similar to the analysis of Operational Ratings. This is because energy consumption is a key factor in the calculation of the OR.

Chart 4 shows the trend in the total energy consumption distribution for premises with DEC based on the same sample as the OR analysis as set out in table 2.

It shows that the median energy consumption fell by 11 per cent over the course of 3 years.

Chart 4: Trend in Energy Consumption – all DEC

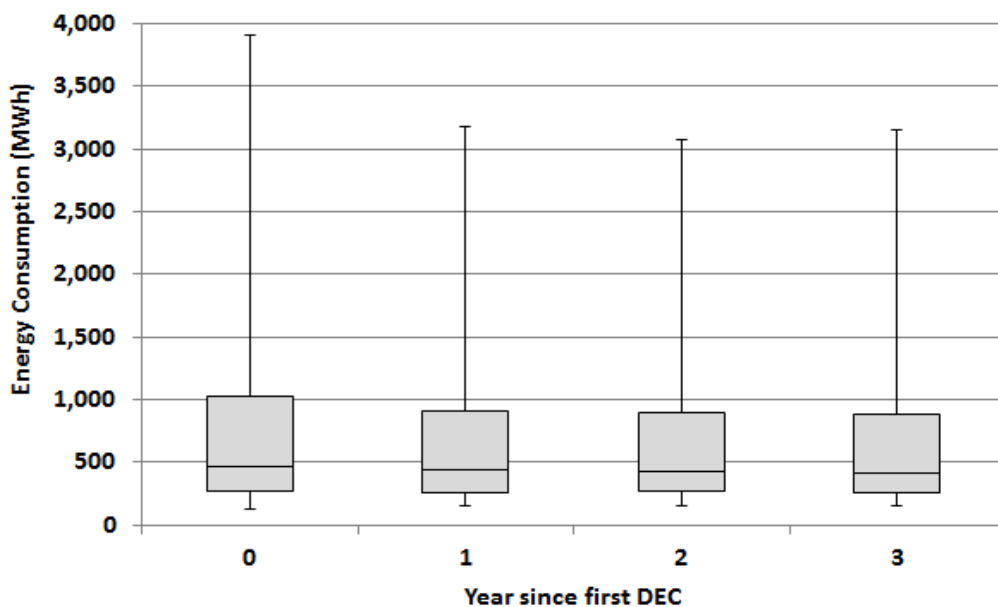
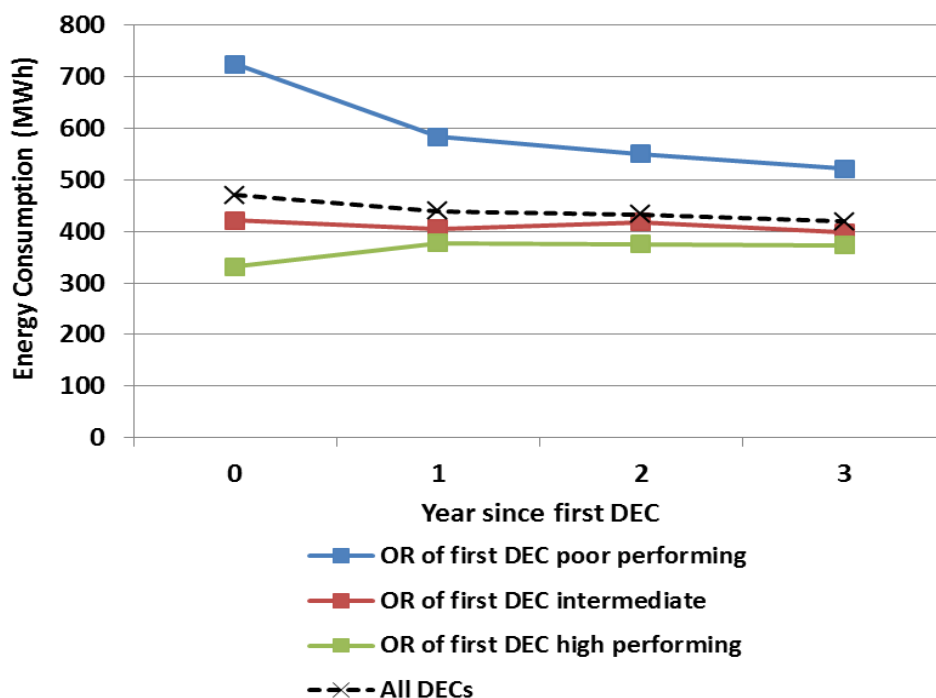


Chart 5: Trend in median Energy Consumption based on performance of first DEC



Once again a trend emerges if the data is split according to the OR of the initial DEC. Chart 5 shows that median energy consumption fell by 28 per cent for initially poor performing properties, compared to a 6 per cent fall in median consumption for intermediate performing properties, and a 13 per cent rise for high performing buildings.

For both the analysis of Operational Ratings and energy consumption it is not possible to fully attribute this improvement to the DEC itself but it demonstrates changes in energy use / emissions following changes in building energy efficiency or management. It is therefore necessary to construct a counterfactual to further analyse the impact of DEC.

The Counterfactual for Offices

To attempt to isolate the impact of DEC on energy performance, a counterfactual was constructed to compare the change in energy intensity (energy consumption per meter squared of floor space) between buildings with DEC and those that did not. This has been done for offices as they are considered the most comparable building between public and private sectors with a reasonable number of records in both groups. There are a limited number of schools captured in NEED⁵, outside the public sector.

Private sector offices were identified using NEED which links consumption data with property attribute and business data. Since DEC are only required for buildings over 1,000m² of floor space this filter was applied to the NEED data.

⁵ Since NEED does not contain all non-domestic properties this analysis is comparing two samples.

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To control for differences in office size, energy intensity was chosen as the preferred variable to compare.

Since only 12 per cent of premises with DEC are offices, the sample is much smaller than in previous analyses.

Chart 6: Comparing private sector offices to public sector offices with a DEC ⁶

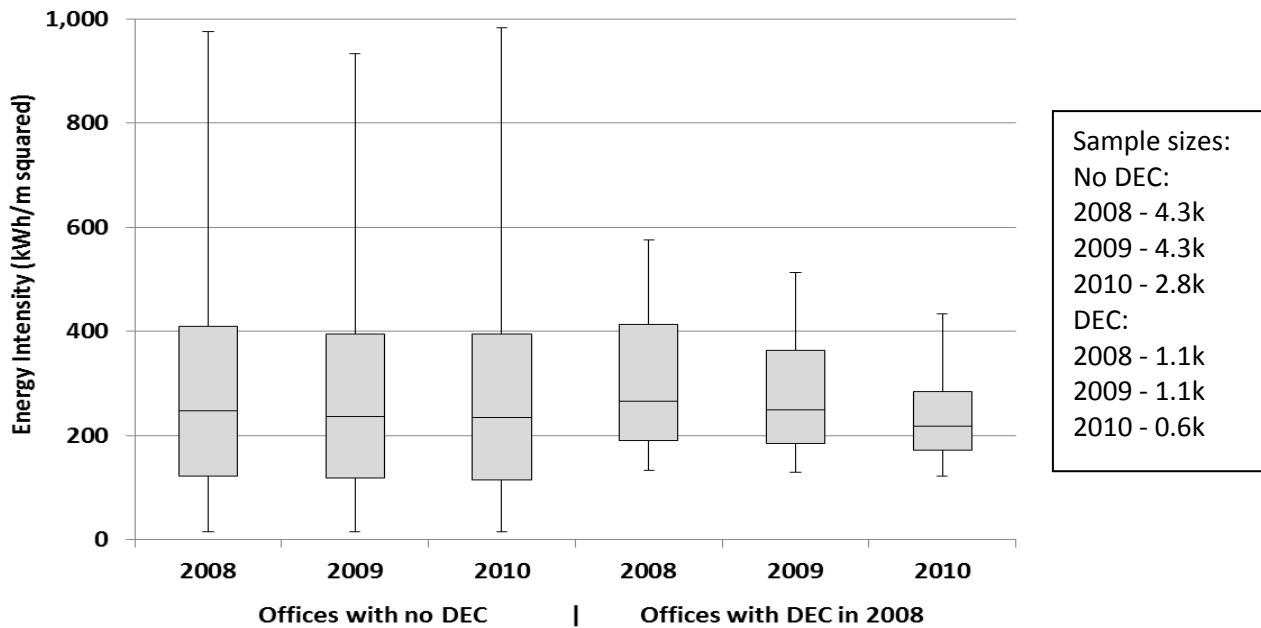


Chart 6 shows that the energy intensity distribution for offices without a DEC was relatively static between 2008 and 2010, whereas for offices with a DEC, there is a clear shift downwards over time.

Tables 3 and 4, show the year on year percentage changes in energy intensity for these distributions.

Table 3: Percentage change in energy intensity: 2008 to 2009

	No-DEC	With DEC	Difference
Upper Quartile	-3.6%	-12.3%	-8.7%
Median	-4.3%	-6.0%	-1.8%
Lower Quartile	-3.5%	-2.6%	+0.9%

⁶ Sample sizes in 2008 and 2009 are equal since only offices with data in both years have been selected. The sample size falls for both DEC and non-DEC for the same reasons set out previously.

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Table 3 shows that median energy intensity for offices with a DEC fell by about 2 percentage points more than offices without a DEC between 2008 and 2009. This counterfactual comparison does not control for all factors. One possible reason for the disparity other than a DEC is the potential that other public sector initiatives reduced energy intensity in public sector offices although these are not considered significant over this period. The analysis for offices with DECs is consistent with earlier analysis showing greater reductions for initially lower performing DECs (represented by the upper quartile) with very small changes for the higher performing DECs (represented by the lower quartile).

Table 4: Percentage change in energy intensity: 2009 to 2010

	No DEC	With DEC	Difference
Upper Quartile	-0.1%	-21.8%	-21.7%
Median	-0.8%	-12.9%	-12.1%
Lower Quartile	-3.0%	-7.3%	-4.3%

Table 4, shows larger differences between 2009 and 2010 than between 2008 and 2009. The reasons for this have not been explored but it is likely to be influenced by other public sector initiatives, for example the Government's 10 per cent carbon reduction target⁷. The sample size is also smaller for reasons set out previously which may affect the accuracy of results in table 4.

User feedback

Please send any comments or queries about this article to:

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⁷ <https://www.gov.uk/government/organisations/prime-ministers-office-10-downing-street/about/our-energy-use>