DesignBuilder Used to Improve 1980s London Office EPC Rating for MEES compliance

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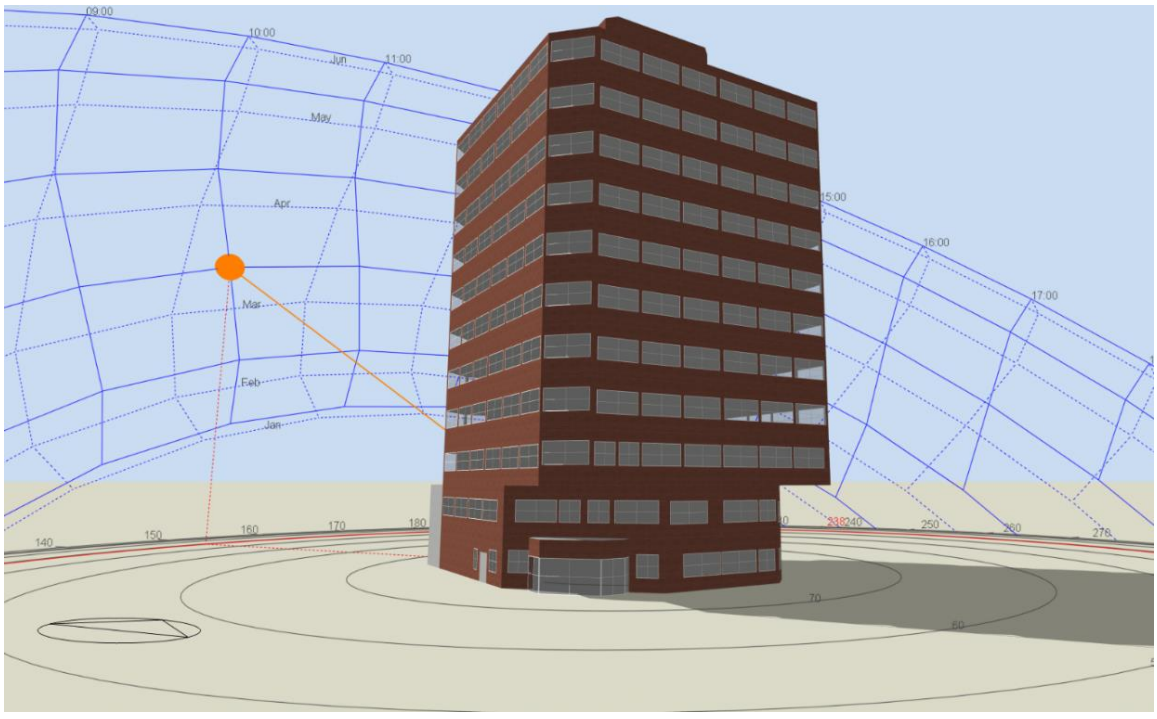
Business Footprint were recently appointed to prepare a whole building Energy Performance Certificate (EPC) for an office block in London. The original asset rating was a "G", so we were also required to identify appropriate energy conservation measures to improve the rating to an E or better for compliance with the Minimum Energy Efficiency Standards (MEES). We modelled the building in DesignBuilder and were able to quickly evaluate the results in both SBEM and DSM "modes", identifying that we could potentially improve the rating for this building to a "D" with an additional 7% improvement using DSM instead of SBEM.

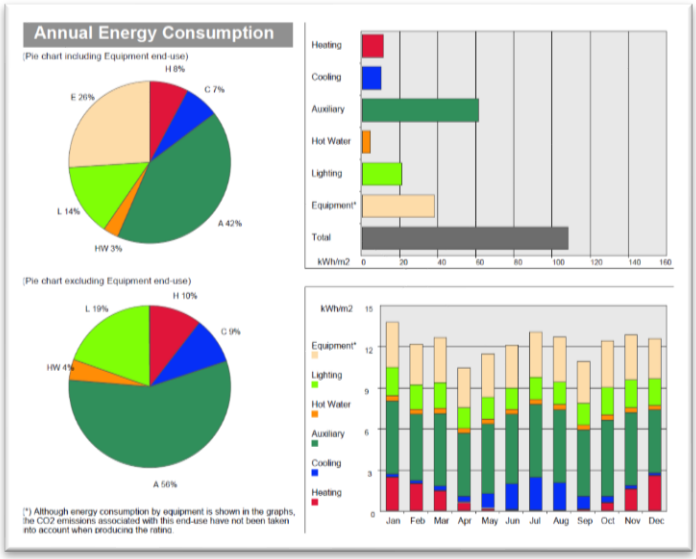


Building Summary

- 6,800 m2, architect designed 12-storey office block completed in the early 1980s.
- Single supply and extract AHUs serving largely open plan floors.
- Each floor has a number of "Versatemp" water loop heat pumps.
- Gas boilers feed a HWS calorifier and top up the Versatemp water loop.
- Heat is extracted via 3 rooftop dry air coolers. Some ground and second floor offices have independent DX cooling with perimeter trench LTHW convectors.
- Standard T8 office lighting with tungsten spot lighting in the reception areas.

Methodology

After setting up the model using DesignBuilder's rapid geometry tools and data input system we were quickly able to analyse the results. DesignBuilder includes comprehensive libraries of all the NCM inference and library constructions which made modelling this existing building much faster. The ability to quickly create and update the model and generate new results is even more important for MEES as you really need to test the impact of different options. The annual energy consumption report allowed us to readily visualise where the improvements would be found.



The SBEM model was switched to DSM and some minor changes were made to the to enable a quick comparison between the SBEM and DSM results. The main changes were to load the hourly weather file and include the additional shading from surrounding buildings and internal blinds.

Results

The table below details of the SBEM EPC results and illustrates how the recommended energy conservation measures would affect the EPC rating.

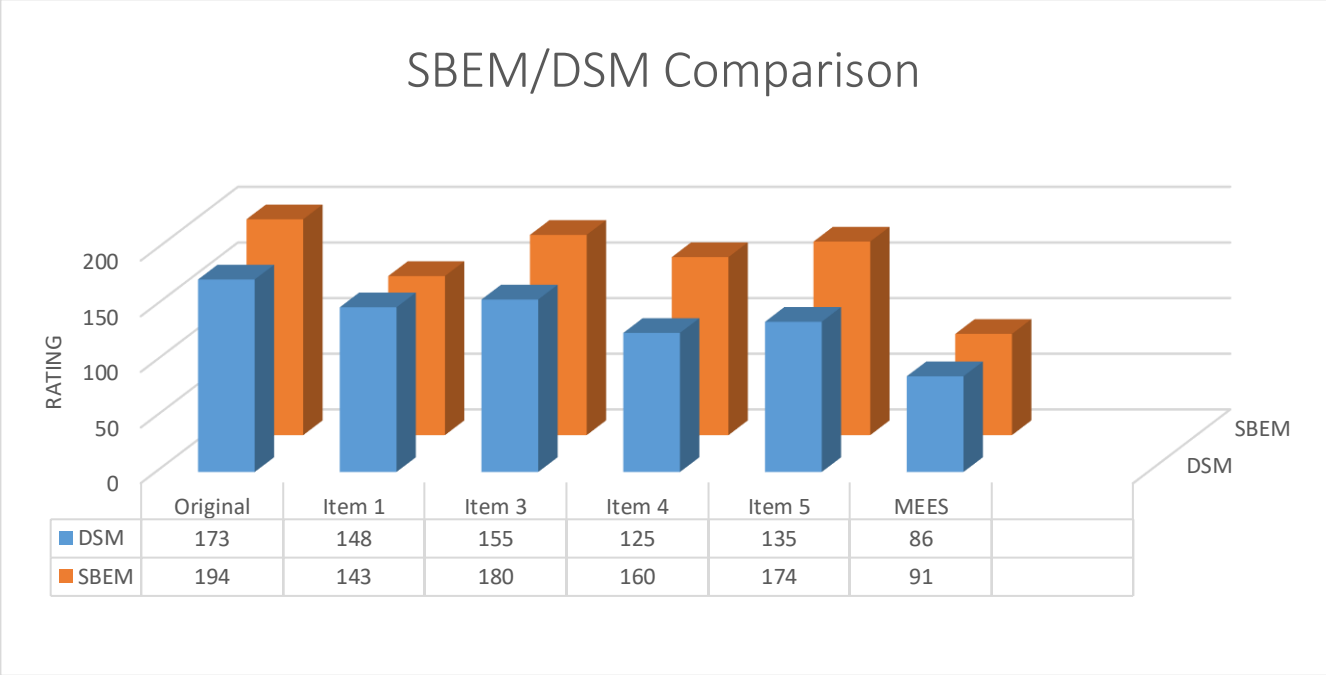
Item	Name	Description	New Rating Band	Rating Improvement	Notes
1	AHU	Replace/Refurbish AHU.*	F (143)	51	The current model has a Specific Fan Power (SFP) of 2.2 W/l/s. Our recommendation was to replace this with a new AHU with a minimum SFP of 1.5 W/l/s which brings it in line with the NDBSCG and also a thermal wheel heat recovery with an efficiency of 75%.
2	HWS	Replace calorifier and all under sink units with instantaneous units.	G (195)	-1	This recommendation was rejected as the move away from a gas boiler fed HWS calorifier to instantaneous electric heaters appears to slightly worsen the rating.
3	Lighting	Change lighting from T8 to modern T5 or LED without a lighting design.	G (180)	15	This result is produced by replacing the current lighting without having a lighting design undertaken. The standard (pessimistic) NCM values for T5 or LED would be used.
4	Lighting	Change lighting incorporating a lighting design.	G (160)	35	This assumes the use of PIR occupancy sensing and photoelectric controls in appropriate areas. A speculative lighting power density of 7 W/m2 was used.
5	HVAC	Replace all older Clivet versatemp terminal units with modern units.	G (174)	20	A speculative assumed system terminal unit SEER & SCOP of 4.7. It is noted that a more detailed specialised pre-installation assessment by Clivet, incorporating water loop ΔT and DB/WB figures could produce larger efficiencies and therefore a better rating. Their pre-installation assessment may well conclude that the rooftop Searle dry air coolers also need replacement.
6	MEES Compliant	Install 1, 4 & 5 recommendations.	D (91)	104	Installing points 1, 4 & 5 produces a MEES compliant building. As noted, it would also improve occupant wellbeing and productivity and improve indoor air quality.

* Note that the current AHU is beyond its useful life and requires replacement in any case. During the site inspection, a random sample of floors were not found to be receiving fresh air at all. This reduces occupant wellbeing, with a corresponding reduction in worker productivity and an increase in sick days.

Main Findings

The main findings were:

1. The asset was originally G (194) rated.
2. Investigation and analysis of the previous EPC xml file revealed that the original EPC (completed by another company using the iSBEM interface) was incorrect. Most notable was the incorrect allocation of the Versatemp system as a 'gas fired convector' system which had a hugely negative impact on the original rating.
3. It is possible to improve the EPC rating to a D (91) through a combination of energy conservation measures using SBEM. This can be further improved to D (86) using DSM.



	Original	Item 1	Item 3	Item 4	Item 5	MEES
DSM	173	148	155	125	135	86
SBEM	194	143	180	160	174	91

The final L5 DSM rating was D (86), a potentially useful improvement on the SBEM D (91) rating. In many buildings this scale of improvement provided by DSM could be sufficient to drop the rating from an F to an E and ensure MEES compliance.

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Further Analysis

Further analysis, using DesignBuilder's EnergyPlus Dynamic Simulation is possible, using the same model. This could include occupancy wellbeing and satisfaction studies for any of the recommendations, using the established Fanger PMV (predictive mean vote) & PPD (Predicted Percentage Dissatisfied) models. The potential benefit of a more productive workforce can contribute positively towards the decision-making processes that occupiers undertake when determining whether or not to lease a commercial property. Should the client want to assess the cost implications of the recommended energy conservation measures the same model could also be used to undertake more detailed cost-benefit analysis using DesignBuilder's cost and optimisation tools.

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