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Normalisation - The new normalisation?

- We are hearing a lot about the new normal.
- In the world of energy management/energy performance of buildings we try to compare current performance with previous normal performance – in other words, we normalise the data.
- So this webinar is posing the question – in the new normal, how do we normalise?
- Expectation management – I don't have the answers, but I hope that by asking the right questions we can all work out the right answers.
- I will start with a recap so that we are all on the same page.

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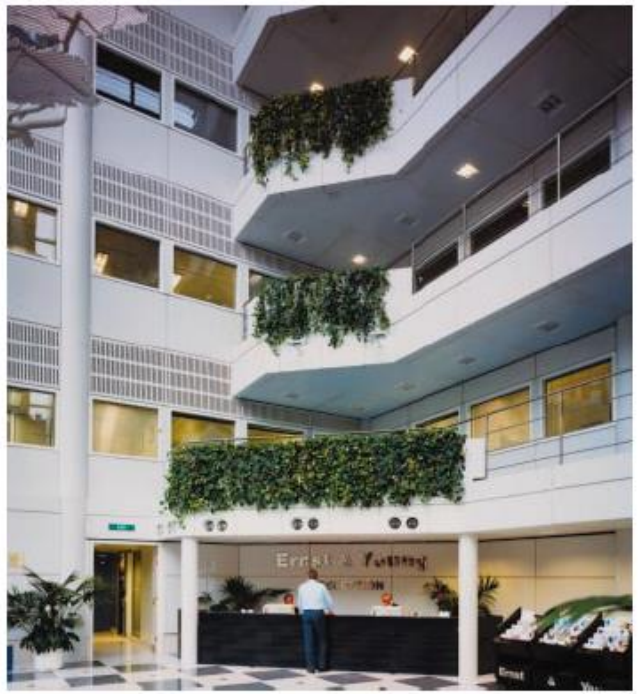
Offices



This was my introduction to energy management in the 1980s.

It is very simple guidance from the government on how to improve the energy performance of your building stock – so interest in this area is not new.

ENERGY EFFICIENCY

BEST PRACTICE PROGRAMME

According to this Guide assessing the energy performance of a building allows you to:

- Compare the performance of your building with best practice to identify the potential for improvement.
- Compare with other buildings in a portfolio to help identify priorities for action.
- Compare with performance in previous years to monitor improvement progress or to assess the impact of any particular changes or improvement project.
- Consider the energy use in more depth to help understand where energy is used and wasted, and hence where savings are most likely to be made.

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Compare with performance in previous years to monitor improvement – Modern manifestations

- Display Energy Certificates – Use normalisation – Degree Days for heating fuel correction and occupancy hours. Interestingly the DEC software only allows for increased occupancy hours, not reduced.
- ESOS driven, or any energy improvement project – Needs normalisation
- ISO 50001 – Requires normalisation
- ISO 50006 – explains normalisation

From ISO 50006:2014

- The “Offices” guide explains the use of Energy Performance Indicators(EnPI) and normalisation factors, but I am going to skip forward to today and use ISO 50006 terminology, but the principles are unchanged:

- The Energy Performance Indicator (EnPI) is a quantitative value that requires identification of a static factor. In offices this is usually floor area, something that impacts energy use, and doesn’t usually change, giving us kWh/m^2 as an EnPI.

ISO 50001:2018 Clause 6.5 Energy baseline (EnB)

- The organisation shall establish an EnB using the information from the energy review taking into account a suitable period of time.
- Where the organisation has data indicating that relevant variables significantly affect energy performance, the organisation shall carry out normalisation of the EnPI value(s) and corresponding EnB(s).

ISO 50001:2018 Clause 6.5 Energy baseline (EnB)

- The organization shall establish an EnB using the information from the energy review taking into account a suitable period of time.
- Where the organization has data indicating that relevant variables significantly affect energy performance, the organization shall carry out normalization of the EnPI value(s) and corresponding EnB(s).
- NOTE: Depending on the nature of the activities, normalisation can be a simple adjustment, or a more complex procedure.

Normalisation

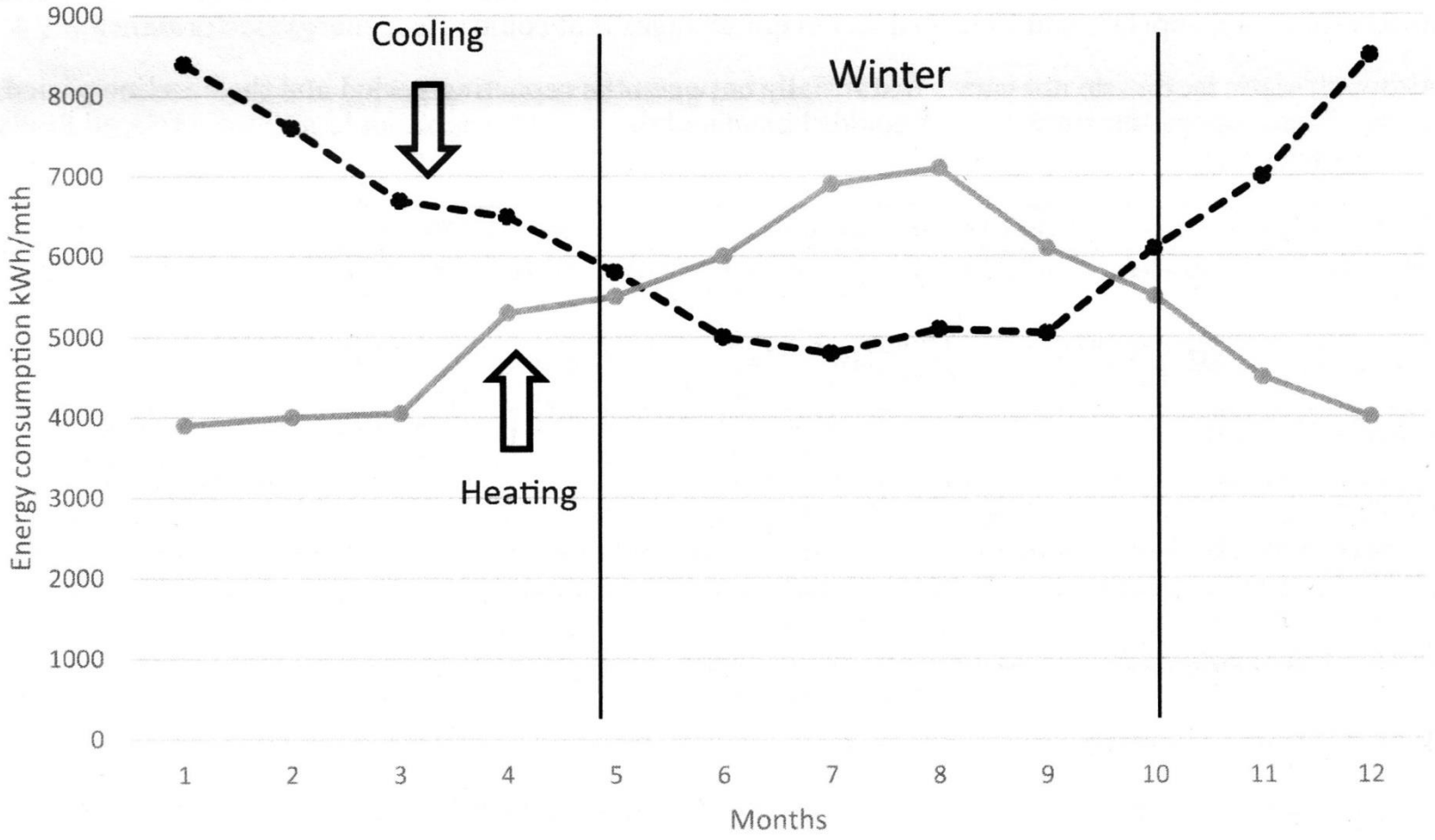
- Normalisation - when monitoring over time, you need to identify relevant variables, things that impact energy use, but change over time, in offices this is typically weather and occupancy hours.

- (ISO 50006 definition – Normalisation – the process of modifying energy data in order to account for changes in relevant variable to compare energy performance under equivalent conditions).

Normalisation – Weather - Recap

- There is, typically, a correlation between degree day data heating fuel use.
- Put simply, the bigger the number, the colder it has been and the more fuel will be used.

Trend chart showing seasonality



Source ISO 50006:2014

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Normalisation – Weather - Recap

- So if your reference year had a degree day figure of 2500, and your current year was milder, say 2000, you need to normalise your EnPI by 2500/2000.

- So 250 kWhr/m^2 becomes 250 * 2500/2000 = 312.5 kWhr/m^2.

(This is what you would have used with similar weather to the reference year)

If your reference figure was 320 kWhr/m^2 you have demonstrated a modest improvement rather than the apparent larger improvement.

Normalisation – Weather - Recap

- If your current year was colder, say 3000 degree days, the EnPI becomes 250 * 2500/3000 = 208 kWhr/m^2.

(This is what you would have used with similar weather to the reference year).

- If your reference figure was 200 kWhr/m^2 you have had a slight drop in performance rather than a major drop.

Normalisation – Weather - Recap

- Just to be clear, your actual consumption was 250 kWhr/m^2.
- The variation that I have used in illustration is at the extreme end of the range but is real.
- If your portfolio is spread throughout the UK you also need to weather correct in year, as North to South there is also a 20% variation.

What about other energy uses – not offices

- Floor area will not always be an appropriate static factor:
  - Other examples could be number of occupants/users, numbers of products manufactured, volume of material produced or for transport – MPG?
  - Normalisation of manufacturing energy use is more of a challenge. Degree Day data is available from 3rd parties, but organisations will need to compile sufficient data to apply normalisation themselves.

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Normalisation

- Degree Days are easy, but what about the rest?
- Appendix D of ISO 50006 is a good place to start.

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From Appendix D

Normalisation is being used to describe the process of modelling energy consumption data with respect to relevant variables in order to compare energy performance under equivalent conditions. Typically, statistical methods such as linear regression are used to normalise or model energy consumption with respect to relevant variables.

The model of energy consumption is developed using the values for production volume during the baseline period. The model in this case only uses one relevant variable – production. The model estimates or predicts energy consumption, Erep_est, based on the values for the relevant variables during the reporting period. The difference in energy consumption, ΔE, between the actual energy consumption, Erep_act, and the estimated energy consumption is the calculated energy performance improvement.

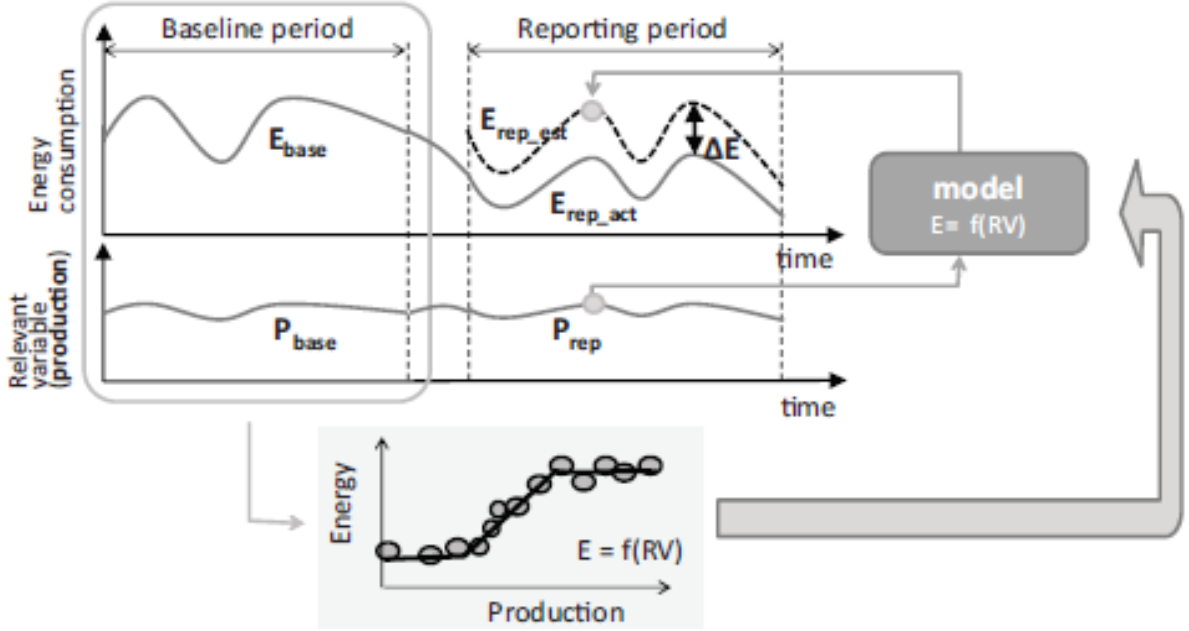

Figure D.2 — Normalization calculation process

From an earlier slide

- NOTE: Depending on the nature of the activities, normalisation can be a simple adjustment, or a more complex procedure.

Normalisation – Keep it in perspective

- What happens if you don't normalise?
  - You won't know the true situation.
  - You may over-estimate or under-estimate the improvement outcome of a particular project with a risk of making the wrong decision about repeating the project elsewhere.
  - You may miss a problem developing
  - You won't be able to demonstrate continual improvement (ISO 50001:2018) or you'll find it difficult next year

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Normalisation – Keep it in perspective

- Keep normalisation activity in proportion
- A full statistical analysis may not be appropriate for a small project.
- However, you need to do something. You will need some sort of model to analyse the data. You cannot rely on a hunch, although you may start there.
- Have a good look at Appendix D ISO 50006:2014 but also have a look at the CIBSE energy benchmarking site and particularly the references at the bottom of the page.
- https://www.cibse.org/knowledge/digital-tools/the-energy-benchmarking-tool-(beta-version)

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Normalisation – Keep it in perspective

- So let's just go for the simple building situation to illustrate the cautionary principle -1
  - Degree Day correction – this only applies to heating fuel, and in many modern, well insulated buildings the heating energy is less than 5% of the total energy use of a building. At the extreme, we could be looking at a 20% variation on 5% - so 1%.

Normalisation – Keep it in perspective

- So let's go for the simple building situation to illustrate the cautionary principle - 2
  - Extended occupancy hours = more energy use? If there are no zone controls, energy use might be the same with 5% of the building used, as when fully occupied for the extended hours so normalisation not appropriate.

(DEC methodology suggests that normalisation is only appropriate for >25% of area used).

So – the new normal

- How have businesses changed and how does that impact energy use?
- The energy use will be what it is, but we still need to evaluate performance for all of the reasons already stated.
- CIBSE's post COVID advice for mechanical ventilation systems suggests increased air change rates and 24/7 operation. Can impact on energy be modelled? (Actual or calculated).

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Has industrial energy use been impacted?

- Consider Production lines working 24 hours with three 8 hour shifts.
- Energy Performance Indicator kWhr/kg of raw material converted into product.
- Post Covid there is now a 1 hour gap between shifts so for 3 hours out of 24 there is no product output.
- Data exists for no product output for shorter periods for product changeover.
- A normalisation factor can be developed.

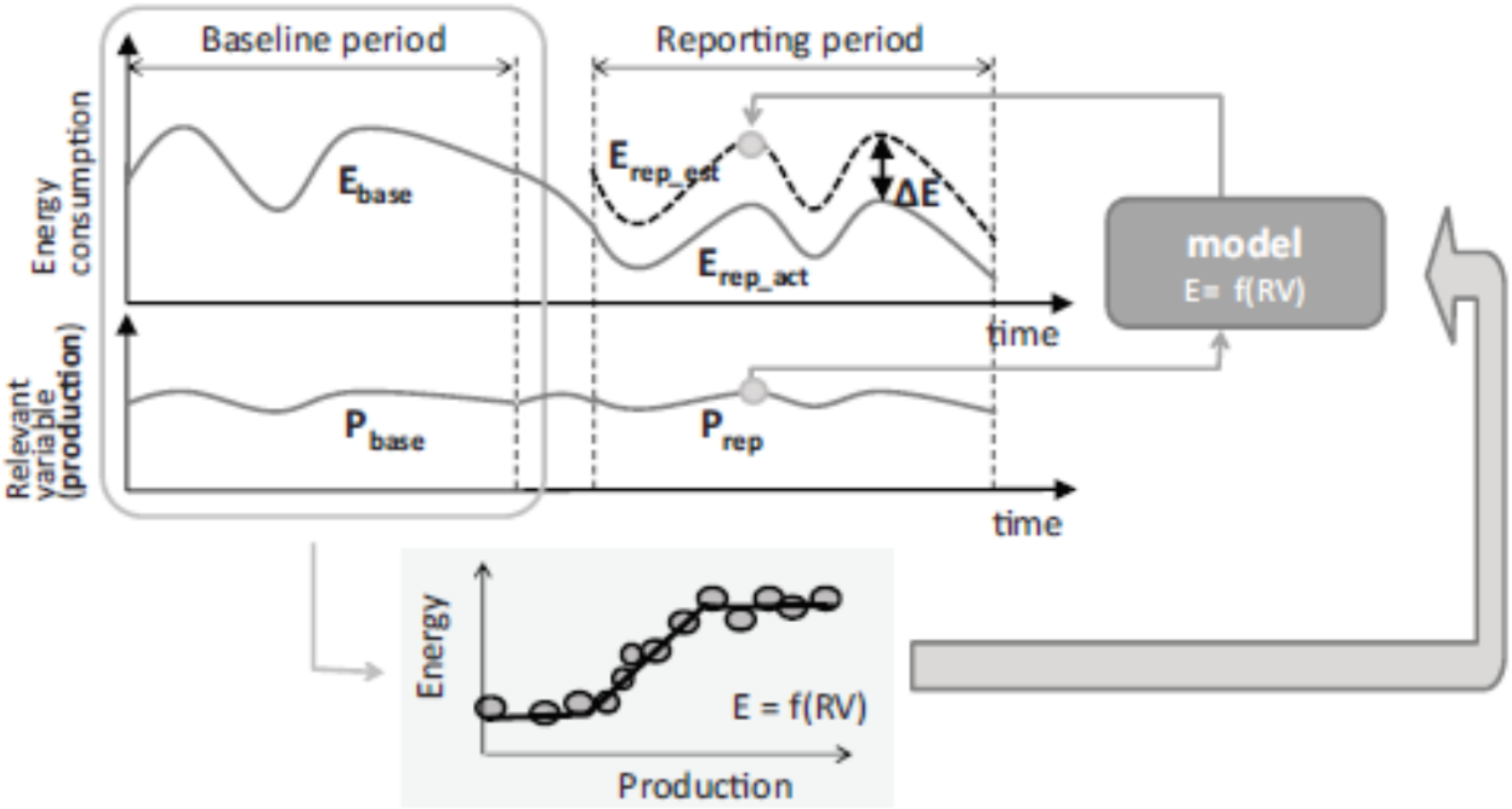

Figure D.2 — Normalization calculation process

Normalisation not possible?

- For a one-off project – be aware – estimate effect of change, up or down – explain. Include estimate of confidence.
- For ISO 50001:2018 as for a one of project if changes are one-off.
- For ISO 50001:2018 if not thought to be a one – off, i.e. a more permanent change in circumstances, trigger Clause 6.5 of ISO 500001:2018 – Energy Baseline (The thing that we are normalising to)

6.5 Energy baseline (EnB)

Where the organization has data indicating that relevant variables significantly affect energy performance, the organisation shall carry out normalisation of the EnPI value(s) and corresponding EnB(s).

6.5 Energy baseline (EnB)

EnB(s) shall be revised in the case of one or more of the following:

a) EnPI(s) no longer reflect the organisation’s energy performance;

b) there have been major changes to the static factors;

c) according to a pre-determined method.

If today's webinar has created an interest in ISO 50006:2014 you might be interested in a webinar that we ran in 2017. Details are still on our website here:

https://www.cibsecertification.co.uk/News/ISO-50006-webinar

Conclusion

- If the post COVID 19 changes are temporary you need to establish a normalisation protocol – simple or sophisticated as appropriate.

- If the post COVID 19 changes are permanent – the new normal, it might be more realistic, and permissible in ISO 50001 terms – the International (Gold) Standard in Energy Management, to start again.

- Making 2020 an important baseline year for energy Management practitioners. Or more likely 2021, because 2020 isn't going to make a good reference year going forward.

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Any Questions?

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